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Editorial Notes

A Memorable Meeting

THIS Special Number of the "JOURNAL" is devoted to a full report of the proceedings of the 74th Annual General Meeting of The Institution of Gas Engineers—a meeting which for a number of reasons can appropriately be described as memorable. In view of the Coronation, the transport strike, and the possibility of a coal strike it was not generally anticipated that in point of numbers attending the meeting would constitute a record. In this as in other respects, however, a record it proved to be. We may mention the actual attendance—1,632—and the fact that for the first time the attendance at the President's reception and dance ran into four figures. A particularly pleasing feature was the very large number of members and visitors from the Dominions and from other countries overseas. The meeting place, the Royal Geographical Society in South Kensington, was, of course, new; but whatever may be said of the general convenience of its situation there was nothing but admiration for the comfort and excellent acoustic properties of the Society's singularly attractive Hall. Comfort alone, however, was not responsible for the measure of members' support of their President, Mr. Stephen Lacey, at every business session of the meeting.

Throughout, the weather was gloriously fine, contributing its share to the enjoyment of those participating in the proceedings, whether in business session or in the extremely well planned visits. The sustained interest and support of so many visitors and members was, perhaps, some small tribute to Mr. Lacey, whose conduct of the meeting enhanced an already deservedly high reputation and doubtless won for him many friends. The enthusiastic reception with which Mr. Lacey was met when he rose to deliver his Presidential Address must have been a source of gratification to him after an arduous year's work carried out so effectively for the advancement of the Gas Industry's progress and prestige. The programme, as we said in our First Institution Number a fortnight ago, was exceedingly well balanced, the various communications linking up to the one aim of giving the consumer the best gas service at a cost as low as possible. Manufacture, including an extraordinarily interesting account of complete gasification in Melbourne, distribution, the future of gas appliance design, the operation and aspirations of holding companies—all these topics came up for discussion. As a whole the discussions were of a high standard and the speakers refrained from wandering from the point. New ideas and viewpoints there were in plenty, though perhaps the discussions lacked a certain fire and spontaneity which characterized some of the discussions at the more informal meetings years ago.

It was good to see Dr. E. W. Smith once again on the Institution platform. His remarks in opening the discussion on the first Paper at the meeting—that in which Mr. C. F. Broadhead expressed many definite ideas as to how the Australian Gas Industry should plan for the future—were obviously thoroughly enjoyed. Then once again, after more than 20 years, Mr. P. C. Holmes Hunt, of Melbourne, returned to the platform—this time not to discuss gas engineering practice but to give useful information on holding company procedure in Australia and to offer a little friendly advice as a result of his long experience of this means of controlling gas undertakings. Nor can we let the opportunity pass of saying how gratifying it was to members of the Institution that Mr. H. James Yates, a pioneer in the establishment of investigation and research in the Gas Industry, should give the meeting the benefit of his views on the future of gas appliance design. There can be nothing but agreement with him in his contention that only through the closest co-operation between the supply side of the Industry and the manufacturers of appliances can a full measure of progress be achieved.

There are only two other matters to which we would refer in these few thoughts on a thoroughly enjoyable and highly successful meeting. The first is that at a special general meeting of corporate members—not open to the Press—a resolution was passed unanimously for the amendment of the by-laws governing admittance to the Institution. The other is that the meeting was the last meeting of the Institution at which Mr. J. R. W. Alexander will act in the capacity of Secretary. In the comparatively short time he has occupied this position his untiring efforts and great organizing ability have played no small part in the enormous increase in status of the Institution and in the influence of its work. The Institution's thanks to him, and good wishes in his new sphere, which does not take him away from either the Institution or the Gas Industry, were expressed at the meeting. A hearty welcome was also accorded his successor, Dr. W. T. K. Braunholtz.

PERSONALITIES AT THE 74th ANNUAL MEETING OF THE INSTITUTION

R. ROBERTSON

(Engineer to the Bristol Gas Company), who becomes Senior Vice-President.

GEORGE DIXON

(Engineer and Manager at Nottingham), the newly-elected Junior Vice-President.

JOHN TERRACE,

The Hon. Secretary.

"J. R. W.,"

who is leaving the Secretaryship of the Institution after eight strenuous years.

W. T. K. BRAUNHOLTZ,

the Technical Assistant Secretary, who succeeds Mr. Alexander as Secretary.

The INSTITUTION OF GAS ENGINEERS' Annual Meeting

June 1 to 4, 1937

THE PRESIDENT.

Born at Beckton, in 1885, the son of the late T. S. Lacey, Mr. Stephen Lacey received his engineering training at the City and Guilds College, South Kensington, and after five years with Messrs. G. H. Hill & Sons (Consulting Engineers) entered the service of the Gas Light and Coke Company in 1911 as assistant to the then Distributing Engineer, Mr. H. S. Reeson, whom he succeeded in 1918. Five years later he was appointed Deputy to Sir Francis Goodenough devoting special attention to the technical activities of the Department which, in 1926, was established at Watson House. On the retirement of Sir Francis in 1932, he became Controller of Gas Sales. Mr. Lacey is a Fellow of the City and Guilds of London Institute, and a Member of the Institution of Heating and Ventilating Engineers. He has twice been the recipient of the I.G.E. Gold Medal (in 1923 and 1928) for Papers on the subject of Gas Distribution.

A Review of the Proceedings

The business sessions were held in the Hall of the Royal Geographical Society, Exhibition Road, Kensington, S.W. 7—Mr. STEPHEN LACEY, B.Sc., M.Inst.C.E. (the President), in the chair. Below we begin our Review of the Proceedings, while a full report of the discussions on the various Papers, together with a record of other business, social functions, and visits, will be found on subsequent pages of this issue of the "JOURNAL."

A RECORD attendance greeted Mr. Stephen Lacey when, as President, he took the Chair at the 74th Annual General Meeting of The Institution of Gas Engineers on Tuesday of last week. The meeting place was the Hall of the Royal Geographical Society, a most comfortable theatre possessing excellent acoustic properties. A particularly pleasing feature was the large number of members and visitors attending from the Dominions.

Mr. J. R. W. Alexander, whose last meeting it was as Secretary of the Institution, having read the notice convening the meeting, the President welcomed those present, expressing gratification at the presence of so many distinguished members and visitors from overseas. These were Messrs. F. Bedford, Singapore; C. F. Broadhead, Melbourne; J. W. Brown, Barbados; B. F. Browne, Santos; Dr. Ing. I. A. H. Glenck, Berlin; Messrs. A. F. P. Hayman, representing the Belgian Gas Association; P. C. Holmes Hunt, Melbourne; J. Irminger, President of the Norwegian Gas-Works Association; S. Barker Johnson, Colombo; V. Y. Kimpton, Melbourne; Sir Harold Luxton, Chairman of the Metropolitan Gas Company of Melbourne; and Messrs. J. N. Reeson, Melbourne; and S. MacGregor Reid, Adelaide.

Messages of greeting were received from the Belgian Gas Association, the Australian Gas Institute, the Canadian Gas Association, the Netherlands Gas Association, the Danish Gas-Works Association, the Swiss Society of Gas and Water Engineers, the International Gas Union, the Union Syndicale de l'Industrie du Gaz en France, and from Dr. Hermann Müller, of Dessau, a Past-President of the German Association of Gas and Water Engineers.

On the motion of the President the Report of the Council for the year 1936-37 and the accounts for the year 1936 were taken as read and were adopted. The Report shows that at Dec. 31, 1936, the membership of the Institution stood at 1,649—an increase of 64 on the previous year.

Then came the election of officers. Mr. H. C. Smith was duly elected President for 1937-38, and Mr. G. Dixon Vice-President for 1937-39. Mr. H. D. Madden and Mr. A.

THE PRESIDENT-ELECT.

Mr. H. C. Smith, M.Inst.C.E., Chief Engineer to the Tottenham and District Gas Company.

Morland were elected as Auditors, and Mr. John Terrace was elected Hon. Secretary.

The ordinary Members of Council elected for 1937-40 were Messrs. E. Crowther, E. V. Evans, J. Jamieson, and F. B. Richards.

The names of the District Members of Council nominated by the affiliated Gas Associations for 1937-38 were announced: Messrs. George Wright, Eastern Counties; A. Law, Irish; R. N. Webb, Manchester District; Harold Davies, Midland; George Braidwood, North British; W. W. Atley, North of England; S. E. Whitehead, Southern; and W. H. Johns, Wales and Monmouthshire.

Then, after the election of scrutineers of ballot papers for 1938, came the presentation of Medals. The Institution Gold Medal, 1936, was awarded to Mr. Harold Hollings for his Paper on Gum Formation at last year's autumn research meeting. Mr. J. Jamieson and Dr. J. G. King were awarded the H. E. Jones London Medal for their joint Paper on the Carbonization of Scottish Cannel presented at the annual meeting last year. The Institution Silver Medal was awarded to Mr. C. A. Deas for his Paper on the Dilution of Horizontal Coal Gas to the Southern Association, and the Institution Bronze Medal to Mr. C. Fuller Petersen for his Paper on Coke for the Open Grate before the Wales and Monmouthshire Junior Gas Association.

Mr. Lacey then rose to deliver his Presidential Address, which, restrained and very well balanced, was listened to with the keenest interest and appreciation. Dealing with the work of the Institution, Mr. Lacey remarked that the development of the complementary national bodies during the last 25 years, while relieving the Institution of special responsibilities with regard to administration and commercial affairs, has, at the same time, greatly increased the scope of its responsibilities for scientific technique and development and education in all branches of the Gas Industry. The Institution is fully alive to this, and shows itself as willing and anxious to enlist the services of all who can contribute to its work, whether gas engineers in the traditional sense of the word or not, and whether members of the Institution or not. Since the granting of the Royal Charter the number of members has increased from 1,405 in the year 1929 to 1,649 in the year 1936. This, he said, may be considered as a satisfactory increase, especially having regard to the higher standard of technical qualifications required by the Charter By-laws, but many would like to see an increase of members engaged on the supply side of the Gas Industry in view of the greatly increased importance now attaching to the technical aspects of distribution and utilization. Also it is thought that the membership should include the scientific specialists who now contribute so much to the development of the Industry on its technical side, provided that such men have a broad training and experience in addition to their specialized knowledge.

Mr. Lacey went on to say that the Research Executive Committee of the Institution is planning to establish closer collaboration than in the past with other research organizations, in this country and abroad, and thereby, at relatively little additional expense, greatly to enlarge its field of investigation. And, he observed, the most fruitful research in relation to expense is not necessarily obtained by the maintenance by the Institution of a permanent research staff. The time may come, he hinted, when to a greater extent than in the past the Institution may decide to make grants for particular items of research to be carried out, within definite terms of reference, in such laboratories within and without the Gas Industry as may seem most capable of producing the best results.

One of the major problems of the Gas Industry, remarked the President, is how to maintain proper economic balance between the production and sale of gas and gas coke, which are at one and the same time complementary and in competition with one another—a problem greatly complicated by the erratic demand for and supply of oven cokes, although produced primarily for the heavy industries. Gas is the ideal fuel, and we should look forward to the time when the use of solid fuel of any kind will be a thing of the past. But no good would come of burking the fact that until gas can be sold at a lower average price than at present, the demand for smokeless solid fuels in place of coal will continue, and should be encouraged. There is nothing inconsistent, therefore, in striving for the ideal of complete gasification of coal and, in the meantime, doing everything possible to increase the market value of gas coke by technical improvements in coke and coke burning appliances, and by the application of sales methods not less enterprising and intelligent than those applied to the sale of gas.

Discussing the grouping of gas undertakings, Mr. Lacey observed that, while co-operation between existing gas undertakings is all to the good and ought to be encouraged in every possible way, keeping pace with the times involves a degree of specialization which is only possible in organizations on a fairly large scale, and for that and other reasons the grouping of undertakings by one means or another should be welcomed. It is to be hoped, he continued, that in the development of holding companies the advantages of grouping on a regional basis will be borne in mind; and also that we shall not see a form of competition within the Gas Industry which, in the long run, might reduce rather than increase its power to meet competition with other industries. The Institution's special concern with the holding company movement is the beneficial effect on technical control and development that the grouping of undertakings makes possible.

A vote of thanks to the President for his Address was moved by Mr. J. H. Canning and seconded by Mr. R. E. Gibson. Mr. Canning, who described the Address as fully worthy of the deservedly high reputation of its Author, took the opportunity of expressing the whole Industry's gratitude for the help afforded by the great Company which Mr. Lacey serves and spoke of the improvement in the standards of gas service as a result of the work of Watson House. He also appealed to all present at the meeting to do everything to support the Industrial Gas Centres.

Consolidation of Gas.

TO Mr. C. F. Broadhead, of Melbourne, fell the honour of presenting the first Paper at the meeting. The title of the communication—The Consolidation of Gas—indicates the leanings of the Author, in his particular circumstances, towards complete gasification. We say in his particular circumstances advisedly, for conditions in Melbourne are very different from those obtaining at the present time in Great Britain. In the area of supply of the Metropolitan Gas Company of Melbourne coke is up against the competition of cheap brown coal briquettes and fuel oil, and the bottom has been knocked out of the tar market. It is the Author's opinion that the cultivation of the domestic coke field should be abandoned, with the possible exception of blocks of flats, where labour has to be employed in any case. During the past ten years a debacle has occurred in the tar market, and the decrease in revenue from tar to the Company is estimated at £450,000 during this period; the tremendous falling-off in tar sales has forced the Company to sell large quantities of tar as fuel. During the past decade the coal consumption for carbonization has been reduced by approximately 75,000 tons per annum. All horizontal and inclined retorts have been scrapped and a carburetted water gas plant has been substituted. Since its installation in 1929 this plant has worked continuously, and, in the Author's words, " is without question the most perfect piece of gas-producing plant yet devised." The thermal production of carburetted water gas in 1936 amounted to 21% of the total make, and the cost of production proved less than the equivalent cost per therm in vertical retorts. Moreover, the Author contends that the direct saving is only a small part of the total advantages derived from the manufacture of water gas in Melbourne. Since 1926 approximately 50,000 tons of coke per annum has been taken off the local market, and the sale of tar to municipalities and distillers has decreased by 3,000,000 gallons during the same period.

During the past twenty years it has been Mr. Broadhead's increasing conviction that the solution of the main problem in Australia—a balanced production and sale of gas and residuals—lies in the direction of complete gasification. It was not until two years ago, however, that his Company were in a position to attempt the design of a pilot plant capable of gasifying any type of solid and liquid fuel to produce a gas suitable for town supply. The problem for investigation was to ascertain the practical possibility of operating a complete gasification plant, which it was proposed should consist of three simple generators, in such a manner that a continuous production of gas was ensured. The operations were to be so synchronized that while the first generator was blowing, the second in series would be up-running and the third down-running. At the change of cycle the one that had been down-running would go on to the blow, the one that had been blowing would go on to the up-run, and the one that had been up-running would go on the down-run. Thus they would be operated in rotation, each being subjected to precisely the same conditions. Immediately a generator commences to up-run, fuel is added to that generator and the volatile matter from the fuel expelled during the periods of up-run and down-run. When a generator is down-running, tar or oil is cracked to gas by spraying it on to the surface of the fuel bed of that generator, carburetting the gas to any desired calorific value. The combination of coke and tar proved the best for gas-

THE 1936 INSTITUTION MEDALLISTS

GOLD MEDAL.

H. HOLLINGS

For Paper "The Formation of Nitrogenous Gum During the Storage and Distribution of Gas," read at the 8th Autumn Research Meeting of The Institution of Gas Engineers in London on Nov. 4, 1936.

SILVER MEDAL.

C. A. DEAS

For Paper, "The Dilution of Horizontal Coal Gas," read at a general meeting of the Southern Association of Gas Engineers and Managers in London on Nov. 27, 1936.

BRONZE MEDAL.

C. F. PETERSEN

For Paper, "The Manufacture and Treatment of Gas Coke with particular regard to its Sales and Use for Open Grate Purposes," read at a general meeting of the Wales and Monmouthshire Junior Gas Association in Newport (Mon.) on Jan. 25, 1936.

H. E. JONES LONDON MEDAL.

J. JAMIESON

J.G. KING

For Joint Paper, "Products Obtained by the Carbonization of Scottish Cannel in Continuous Vertical Retorts," read at the 73rd Annual General Meeting of The Institution of Gas Engineers in London on May 28, 1936.

making capacity. At the termination of two years' experience on the operation of this process and plant the opinion was formed that it is fundamentally sound. A plant to manufacture about 500,000 cu.ft. per day has been designed which it is proposed to erect at South Melbourne Works.

In the section of the Paper dealing with condensation, washing, and dehydration the view is put forward that this branch has not received the attention it deserves, and the belief is expressed that an extension of the intense cooling process could be made to perform a dual purpose—viz., to reduce the temperature of the water in the washing system and to dehydrate the gas subsequent to purification. This would have the effect of increasing the capacity and efficiency of the washers and reducing the percentages of water, ammonia, naphthalene, organic sulphur compounds and gum-forming constituents to a degree in which they become innocuous. The Paper also discusses the im-

provements made in the distribution of gas in the area of supply of the Melbourne Company, and mention is made of the Construction Department. The Company constructs most of its plant in its own workshops, only very specialized machinery being obtained from other sources. The pioneering work done with electric arc welding and flame cutting, which dates back to 1920, has led to the development of a special technique in the design of steel structures with consequent distinctive features which are peculiar to the Company's plant. The department has built ten arc-welded gasholders, including four of 3 million cu.ft., three of 1 million cu.ft., and three of 500,000 cu.ft. capacity. In other directions there are arc-welded retort houses, purifiers, condensers, coal and coke handling plant, and so on.

Mr. Broadhead has an interesting comment on calorific value. The Gas Regulation Act, 1933, fixed the calorific value of the gas at 500 B.Th.U. for all undertakings in Victoria sending out over 25 million cu.ft. per annum. To the Author the time appears ripe for a consolidation of calorific values in Great Britain. It would be difficult, he maintains, to advance sound reasons why suppliers should require to send out gas over the present range of calorific values. "It is a fair assumption that the damage done in distributing systems by undesirable constituents of low grade gas produced in the usual way outweighs any benefits conferred by latitude which is presumed to be of such value. It would be to the advantage of consumers and of immense benefit to appliance manufacturers if calorific standards were confined to alternatives of say, 500 or 400 B.Th.U. gross."

The final section of the Paper is devoted to sales. In 1934 a Controller of Sales was appointed by the Metropolitan Company. This officer was entirely new to the gas business—in fact, he was employed by the principal oil competitor. There is every indication, says Mr. Broadhead, that reorganization and modernization of the sales department will be an unqualified success, which, taken in conjunction with the complete gasification results, "suggests that the economical production and sale of gas alone presents less difficulty than the unnecessarily complicated situation now in existence. The modern tendency towards clean automatically controlled fuel leads one to the inevitable conclusion that future concentration on our main product, gas, could have no result other than a beneficial consolidation of our interests."

A Practical Process.

DISCUSSION on Mr. Broadhead's Paper was opened by Dr. E. W. Smith, whose comments constituted a bright feature of the meeting. His remarks had especial significance, for he has only recently returned from a tour of Australia during which he had the opportunity of visiting most of the large gas undertakings there. When in Melbourne he spent several days studying the complete gasification process dealt with by Mr. Broadhead in his Paper, and at the meeting Dr. Smith expressed the opinion that this process is the only practical one available to the Industry anywhere in the world. As to its place in the Industry, Dr. Smith believes that it will serve as an alternative to semi-carburetted water gas. He emphasized that we must maintain the characteristics of gas constant. Water gas when correctly used is the chief help in enabling the Industry to maintain this constant gas supply, and a water gas from coal is complete gasification gas. Moreover, the use of complete gasification plant is the only means for the Gas Industry, other than by blending, of utilizing non-caking coal. Mr. Broadhead's process, said Dr. Smith, is a continuous one and he was pleased to have the opportunity of congratulating him publicly on what he considered to be a valuable technical development—a development sponsored by an Undertaking which is one of the most progressive in the world to-day. But he stressed that the conditions are such in England that in order to sell gas cheaply it is desirable at the same time to produce satisfactory solid smokeless fuel in the form of gas coke; and in his view this state of affairs will obtain in this country for many years to come. Of the families in this country, 65% have to depend on incomes of less than £3 a week and 85% on less than £5 per week. To these families a shilling or so extra a week spent on fuel represents a considerable item, and if, for certain purposes, coke can give a cheaper heat service than gas then the demand must continue. In any case we have at the moment made only a small inroad into the use of coal in domestic premises.

Discussing another aspect of Mr. Broadhead's Paper, the adoption of refrigeration in the treatment of gas after the retort house, Dr. Smith suggested that this is a direction in which the Gas Industry has left a great deal undone, and that if benzole recovery is to be popular, refrigeration methods should be developed for the treatment of gas. Concluding his remarks, Dr. Smith said that his visit to Australia had impressed him with the keen desire in that country for the completest possible collaboration with Associations in Great Britain. The closer the collaboration, he said, the closer the inter-communication between individuals and Associations, the better it would be for both countries.

The next speaker in the discussion was Mr. R. W. Hunter, who remarked that in the details given by Mr. Broadhead of the savings effected by the remodelling of his coal-unloading plant he found a parallel in his own Company's experience at Beckton and at other works. He made the point, however, that so long as there is the great and growing demand for graded coke in this country, a demand which may continue as long as the British public retain an affection for the open fire, there cannot be the same attraction as for Mr. Broadhead in the complete gasification process. The only other speaker in the discussion was Mr. T. Carmichael, who enquired of the Author whether he had taken any steps to develop coke cutting and grading in Melbourne; and he observed that in this country we are gas-minded and coke-minded, not merely coke-minded. Gas comes first and coke second; and this, he suggested, will be the case for many years to come. Speaking of the prices charged for electricity and gas in Melbourne, Mr. Carmichael remarked that these appeared to indicate that gas is at a disadvantage compared with conditions in this country. This, of course, must render the competition in Melbourne more severe; and any consolidation or development of gas will have to be approached accordingly.

Estimation of Nitric Oxide.

THE business proceedings opened on Tuesday afternoon by the formal presentation of Mr. Hollings' communication on the estimation of nitric oxide in gas. This is a description of an apparatus made by Griffin & Tatlock, Ltd., and devised in the Fulham Laboratory of the Gas Light and Coke Company, for the continuous estimation of nitric oxide. Mr. Hollings explains the method of operation of the apparatus, which has been found to give good agreement with the "spot" test. The President invited written contributions on the Paper, which was taken as read.

Influences in Gas Manufacture.

THEN Mr. E. G. Stewart, of the Gas Light and Coke Company, submitted a Paper on "Changing Influences in Gas Manufacture." In this communication changes in the business conditions of the Gas Industry and its technical progress since the passage of the Gas Regulation Act, 1920, are reviewed; and it is concluded that the intentions of Parliament in passing the Act have been realized in that the cost of gas making has been reduced, statutory requirements have been met, the efficiency of gas manufacture has risen, and the sale of gas has been extended with increased customer satisfaction. Consideration is given to refinements which have been introduced to give better consumer service in recent years, including the removal of naphthalene, water vapour, and sulphur from the gas. Yet, remarks Mr. Stewart, it is somewhat disturbing to find that the adoption of processes of proved value, such as dehydration and the reduction of sulphur compounds, or the generally profitable recovery of benzole, are by no means general. Only one-third of the total gas made is treated for dehydration or benzole recovery, while sulphur removal processes are applied to less than 10% of the total.

The calorific values which have been declared throughout the country are examined, and it is seen that 844 gas undertakings have selected 28 different calorific values. Analysis shows that over 90% of the gas sold in this country is of a calorific value between 450 and 500 B.Th.U. The maker of appliances has at present to cater for a number of calorific values, and accordingly provides gas and air adjustments to cover wide ranges. Such adjustments are capable of abuse as well as use. Closer definition of calorific values would make for simpler burners and should cheapen production. It would not seem out of place therefore to expect that in the near future unlimited choice in calorific values will give place to a few standardized values throughout the country, such as 350, 450, 475, 500 and 540. These five would be suitable for any combinations of existing or contemplated means of gas production, while the middle three alone should be acceptable to makers of 90% of the total gas sold, which suggests an even further reduction.

The variations in the properties of gas which affect the operation of the burner in gas appliances are set out, and

reference is made to recent work in Germany, Switzerland, the U.S.A., and this country directed towards the establishment of means of assessing desirable properties in gas to secure the maximum value in use. Calorific value and specific gravity can be measured and controlled with precision. The shape of the flame produced is of considerable importance in order to avoid incomplete combustion, popping back, noisy operation, and so on. This cannot be calculated, and instruments for the empirical assessment of desirable characteristics in gas to produce such flames have been devised.

Flexibility in Manufacture.

TO-DAY those responsible for the development of gas-using appliances are considered to be within measurable distance of gaining ability to specify characteristics in gas which will yield to the gas user proper and highly efficient service. Unfortunately, insufficient work has as yet been done to correlate these tests with the precise composition of individual acceptable gases. In the absence of this information the gas manufacturer can only meet the higher standards of gas quality demanded to-day by limiting the flexibility of his operations, and by avoiding large changes in the use of water gas and diluent gases. Mr. Stewart suggests that limits so imposed need not be very onerous if a stable and remunerative coke market can be established, and the present conditions in coke marketing are examined. The view is held that the outlook for coke presages a growing and remunerative market, which can with care and planning be kept free from the fluctuations of past years. At the same time it is difficult to make gas of a quality within narrow limits of variation and at the same time meet seasonal peaks due to cold weather or other causes. It is shown that hand operated water gas plant is the most economical means at present available for meeting these peaks, but it is probable that some method of balancing the variations in quality due to its use may have to be sought.

In regard to complete gasification, the Author remarks that at present no process of general acceptance is available. Such as do exist would entail large increases in the capacity of holder storage and distribution systems, even if they could produce gas on works at competitive prices. The effect, too, of the withdrawal of the Gas Industry from the coke market, even locally, to any extent, is not easily predicted, but would certainly not help the progress of the new departure. Further, the high carbon monoxide content of the gas produced would be a disadvantage. The work of the Joint Research Committee in investigating the oxygen and high pressure process is to be commended, and it may be that ultimately the future will be concerned with some such process, which would produce gas similar in composition to that from present processes. Meanwhile indications of the early demise of present-day practice are lacking.

It is concluded that the business of gas making is likely to become more complex in future, and that the closest collaboration between engineer, chemist, and other trained scientific workers will become more and more essential. The present trend towards the grouping of gas undertakings, the Author observes, affords an opportunity for such groups to include the provision of corps of specialists to this end. Co-ordinated policy is the theme of the age, and parallel development in manufacture and utilization of gas, coupled with the mass production and national advertisement of appliances, makes it essential that each branch of the Gas Industry should maintain the closest interest in the others' activities. At the same time, no step must be taken which will stultify manufacturing progress or limit more than necessary the present flexibility of gas manufacture to meet changes in market conditions or scientific advance.

The necessity is stressed for the manufacturing side of the Gas Industry viewing critically such gas using appliances as may require undue limitation of gas quality, and certain lines of research of value to it are indicated as desirable. Meanwhile, it is suggested that not only should efforts be made to limit changes in gas composition, but that the benefits of dehydration, denaphthalenation, and reduction of sulphur compounds should be extended as widely and as soon as possible.

Improving Gas Quality.

MR. T. CAMPBELL FINLAYSON opened the discussion on the Paper, remarking that it is important that we should have a clear conception as to what the changing influences in gas manufacture mean. These influences, he suggested, fall into two distinct groups. First, changes brought about for the purpose of improving consumer service, which include such features as naphthalene, water vapour, and sulphur removal, standardization of calorific values, and regular characteristics of gas supplied. Secondly, changes brought about for improving and stabilizing the economics of gas manufacture—such as benzole washing, improved coke markets, and so on. Declared calorific value, he said, if standardized must bear some relation to the type of coal most easily obtainable in any given area. In fact, it does so to-day; as we come South from Scotland to the English Channel there is a definite tendency for the calorific value of gas to rise. Then more attention should be paid to the establishment of controlled cracking in carbonization. Without in any way questioning the economic and national soundness of benzole recovery at the moment, Mr. Finlayson queried whether it is wise to make a fundamental improvement like the removal of organic sulphur dependent upon the removal of benzole from the gas. Might not the time come when, with a public accustomed to sulphur-free gas, it would be necessary to extract benzole purely for the sulphur removal stage? Is it not desirable for the Industry to secure during the next few years some alternative process of sulphur removal which does not necessitate such a substantial stripping of the enrichers from the gas? In regard to the meeting of peak loads without altering the characteristics of gas, Mr. Finlayson spoke of the possibility of operating a carbonizing plant under steaming conditions making gas of required calorific value, then when peak load arises bringing coal throughputs and calorific values of the coal gas up to the maximum and diluting with blue water gas made externally. This method of meeting increased gas load appears to have the advantage of maintaining regular characteristics of gas, but, of course, is not so economical in capital cost as carburetted water gas.

Sulphur Removal.

OUTSIDE London, only some 7,000 million cu.ft. of gas, out of a yearly make of about 320,000 million cu.ft., are treated for sulphur removal. This fact was mentioned by Dr. Harold Hartley, who maintained that those responsible for gas making must tackle seriously this job of sulphur removal. Dr. Hartley also expressed the hope that there would not be more than three standard calorific values. He explained that in his experience the maintenance of a given aeration test burner number does not ensure that the same combustion results will be attained with an appliance, and that more work will need to be done before the ideal test burner becomes available. In this connection Mr. L. T. Minchin, of the Gas Light and Coke Company, said he felt that some criticisms of the aeration test burner are based on rather too sanguine a hope as to what it will do. One must not be misled into thinking that one could describe all the characteristics of gas composition by a single number any more than one could describe the quality of a man by a single number.

In the course of his contribution to the discussion, Mr. W. B. McLusky urged the employment of washing and scrubbing plant of ample capacity, and Mr. Norman Hudson gave an account of the working of the oil washing plant at the Mirfield Gas-Works. This plant is extracting over 2 gallons of benzole per ton of coal carbonized, and the gas supplied to the town contains 1 grain of naphthalene and between 7 and 8 grains only of sulphur per 100 cu.ft. The operation and supervision costs, he added, are very little more in a 100 million works than those for operating a straight benzole recovery plant. Mr. Charles Cooper remarked that it seems to have been assumed fairly generally that in order to ensure a low sulphur content in gas by the oil-washing process the whole of the benzole must be extracted. Actually the sulphur content can be reduced to below 10 grains, down to 5 grains, with a variable extraction of benzole of from 1 to 3 gallons per ton. Mr. W. W. Townsend gave interesting particulars concerning the means he has adopted at Colchester for ensuring at all times a supply of gas of reasonable uniformity. He has horizontal retorts, benzole extraction plant, and water gas plant. The charge is steamed, and when there is a sudden increased demand for gas steaming of the charge is discontinued and the amount of water gas separately manufactured increased. In this way the change in specific gravity which would otherwise occur is counteracted. Also at times the benzole plant is shut off or the water gas lightly carburetted. Another speaker to the discussion was Mr. R. J. Restall who recounted the method employed at Stalybridge with the object of securing uniformity of gas quality.

Institution Membership.

A SPECIAL general meeting of corporate members was then held at which a Resolution for the amendment of the by-laws governing admittance to the Institution was passed unanimously.

Further Greetings.

ON Wednesday morning it was announced that further messages of greeting had been received, in addition to those announced on Tuesday morning. They were from the American Gas Association; the Czecho-Slovakian Gas Association; from Mr. Kirkhope, of Vancouver (offering heartiest congratulations to Mr. H. C. Smith on his election to the Presidency); from Mr. F. P. Tarratt, Past-President; and from Mr. W. E. Price, who was formerly Hon. Secretary of the Institution.

At the suggestion of the President, the meeting resolved that a telegram of good wishes be sent to Mr. Price, expressing pleasure in the fact that his health had improved.

Gas Distribution.

THE first Paper on Wednesday morning was by Mr. H. J. Escreet, Distribution Engineer to the Gas Light and Coke Company. In this the Author gives figures showing the cost of supplying the very rapid housing development which has taken place in the suburban parts of the Gas Light and Coke Company's area during the past 10 years, and also the cost of extending gas supply in the rural parts of the Company's area between Grays and Southend. He shows that the methods of supply adopted —viz., low pressure supply with medium pressure feeder mains for the suburban areas and direct high pressure supply for the rural districts are the most economical systems for the two types of area.

In the first part of the Paper Mr. Escreet explains the method used in the Gas Light and Coke Company for assessing proposals for mains extensions by working out the annual charge for mains per therm of estimated consumption. Since this criterion is used for assessing the probable profit to be gained from the supply of new estates or groups of existing houses not previously supplied, the charge for mains is based only on the cost of the local main extension actually required to afford the supply. In order to obtain the total cost of distribution per therm it is necessary to add to this charge for local mains the charge per therm for trunk or feeder mains and the cost of pumping when medium or high pressure mains are used.

In succeeding sections of the Paper figures are given for the cost of pumping and cost of main-laying, and examples are then given of actual costs of supply on different parts of the Company's area. In the section dealing with pumping costs reference is made to the Company's Gas Grid—a system of medium pressure trunk mains which is used both for the interconnection of the manufacturing stations and for the reinforcement of the low pressure mains system through numerous underground governors. There are approximately 160 miles of mains of diameter from 12 in. to 48 in. in the Grid System and it covers a distance of 37 miles east to west and 13 miles from north to south. The principal station supplying the Grid is Beckton, which has pumping plant of a capacity of 6 million cu.ft. per hour at pressures up to 3 lb. per sq.in. and from which some 22,500 million cu.ft. of gas are pumped annually. The cost of pumping at Beckton amounts to 0·28d. per 1,000 cu.ft. There are a number of other stations pumping into the Grid and the average pumping cost for the whole Grid is approximately 0·37d. per 1,000 cu.ft.

In contrast to the large medium pressure plant at Beckton is the pumping plant at Grays which has a capacity of 150,000 cu.ft. per hour at a pressure of 50 lb. per sq.in. Here the cost of pumping is approximately 4d. per 1,000 cu.ft.

In the section of the Paper dealing with total costs of supply to newly developed areas, particulars are given of the cost of mains in the western area in which 142,000 new houses have been supplied; about 800 miles of main having been laid during the past 10 years, and a large feeder main system developed for the interconnection of manufacturing stations and the supply of some 30 underground governors. In this area the annual charge for local mains has amounted to 1·1d. per therm, to which must be added the cost of feeder mains, 0·35d. per therm, and the cost of pumping, 0·074d. per therm—making a total of 1½d. per therm. The Becontree Estate is quoted as another example. This is a working-class estate of some 25,000 houses and the total cost of supply amounts to about 1½d. per therm.

The third example refers to the Grays area—a sparsely populated rural district in which supply is given direct from high pressure mains. Although the majority of the supply mains are only of 2 in. diameter the charge per therm for mains amounts to 2·8d. and the total charge, including pumping, to 3·6d.

Throughout the Paper Mr. Escreet compares the figures based on the actual cost of supply with the estimated figures given in the Paper on "Economic Aspects of High Pressure Distribution" which was read before the Institution in 1928 by Mr. Stephen Lacey. He emphasizes that a medium pressure feeder main system using large mains and pressures in the region of 2 lb. per sq.in. provides considerable flexibility and may be worked economically over a wide range of outputs. In contrast, a high pressure system with small mains has a small range of economical working.

In the last section of the Paper he puts in a plea for the pooling of information with regard to mainlaying materials and methods, and asks all members to let the Pipes Committee have particulars of experiments or trials which may be of general value to the distribution side of the Industry.

A Factual Discussion.

DISCUSSION on the Paper was opened by Mr. L. F. McLeod, who fails to appreciate why Mr. Escreet is making greater use of half turned and bored joints. Mr. J. A. Gould also expressed his preference for fully turned and bored joints. Mr. Gould spoke of the position which arose when a land developer wished to sell land with roads and a gas supply and other services. In his opinion the developer should enter into an agreement with the gas undertaking whereby he bears the capital cost of the mains, this cost being returnable as the houses are built or connected to the gas distributing system. Alternatively refunds of the capital cost could be made, calculated on the gross gas rental derived from services connected to the mains. Mr. P. Richbell, commenting on the cost of supply to newly developed areas, said that recently the Croydon Gas Company had completed a London County Council estate consisting of 4,200 houses, the average cost per house for mains being £4 11s. 4d. The virtues of steel mains found a firm advocate in Mr. B. R. Parkinson, who cited evidence in regard to their long life. Mr. F. H. Robinson outlined the extensive distribution scheme which he carried out when with the Harrogate Gas Company and offered a criticism of the Grays and Tilbury scheme. The latter, he said, appears to have been designed with a high-pressure of 35 lb. or so and very small mains which allow no margin for future developments. This is an extensive area and its population is increasing fairly rapidly. It interested him to know, however, how the additional consumption is to be met from a distribution system which is apparently already fully loaded. Mr. F. C. Briggs, remarking that the Paper was concerned only with mains, observed that the general manager had to deal with the matter further. Service pipes, meters, and cookers on prepayment meter installations, which most houses on council housing estates entail, and the greater part of provincial development is on those lines, come into the picture. After the payment which can be obtained has been obtained, the total capital expenditure by an undertaking to-day upon suburban development, and more particularly upon local authority schemes, amounts to some £1,500 per million cu.ft. of gas sold, against probably from £250 to £400 before the war. If that were met by the consumers of gas on those schemes, said Mr. Briggs, the price of gas would need to be about 3d. per therm, or 13d. per 1,000 cu.ft., more than it is, in the case of his own Undertaking at Dudley.

Benevolent Fund.

THE meeting was then adjourned to allow of the holding of a general meeting of the contributors to the Benevolent Fund of the Institution. A report of this appears elsewhere in this issue.

Holding Companies.

ON the resumption of the meeting on Wednesday morning, Mr. G. M. Gill presented his Paper on the "Technical Aspects of the Holding Company Movement." The Paper is based upon the experience of two Holding Companies—namely, the Severn Valley Gas Corporation, Ltd., and Gas Consolidation, Ltd., in controlling 36 subsidiary Companies, of which:

*15	make	less than	25	million	cu.ft.	per	annum	
7	,,	over 25	but under	50	million	cu.ft.	per	annum
4	,,	,, 50	,,	100	,,	,,	,,	
4	,,	,, 100	,,	250	,,	,,	,,	
4	,,	,, 250	,,	500	,,	,,	,,	
2	,,	,, 500	million	cu.ft.	per	annum		

* The works of five of these have been, or are being, shut down as manufacturing stations.

Of the 36 works originally in operation before association with the Holding Companies, seven, which were

uneconomic in operation, have been or are being shut down and supplies taken from other works, or in one case from a coke oven plant. This has involved or will involve the laying of 29 miles of new main.

The Author emphasizes that the subsidiary companies are not bought for a cash price, but merely change their directorate and the ownership of the majority of the shares. He explains that the identity of the subsidiary company remains unchanged. In the case of municipal gas undertakings these are bought lock, stock, and barrel by a new company which is formed for the purpose by the Holding Company. He explains in his Paper that the capitalization of the subsidiary companies so acquired is not in any way altered as a result of the control changing, as if too high a price be paid, then it is the Holding Company which becomes over-capitalized. In the early part of the Paper a claim is made that an important advantage accrues, especially to the smaller companies, in the matter of obtaining finance, as the Holding Companies are able to obtain money at low rates, and this advantage is transferred to the subsidiary Companies.

Mr. Gill states that the new Boards of Directors of the subsidiary Companies who are nominees of the Holding Companies are a good deal more enterprising than the usual Board of local Gas Companies, and this has resulted in a considerably increased activity in the direction of new plant, extensions of mains, and the pushing and financing of the hire purchase of gas appliances. He points out that new plant, the installation of which had not been contemplated by the old Boards of Directors, has already been erected or ordered for the works of the various subsidiary Companies, to the amount of £120,000, while the sale of gas appliances has increased by leaps and bounds under the new régime.

He sets out in some detail the duties of the Directors of the Holding Companies who are closely concerned with the management of the subsidiary Companies. He also outlines the type of headquarters' staff who are engaged in supplementing the work of the managers of the subsidiary Companies and explains the nature of the duties performed by such officials. He explains that the underlying idea of the organization is to give service to the subsidiary Companies in the various directions in which ordinarily they would be unable to obtain the services of specialists. Apart from the Directors, four of whom are closely concerned with the administration of the Companies, he explains that there are 16 officials who have specialized knowledge and who visit the various Companies in need of their services, by which means he claims that a gradual improvement can be anticipated in the working of the Companies. He mentions the steps which have been taken to improve the quality and uniformity of the gas supplied. This work has been taken in hand energetically by the appointment of travelling chemists with the assistance of recording instruments whereby the local management is no longer working in the dark. He also sets out in some detail the methods which are followed to assist the Companies in selling modern gas appliances.

For this purpose the Holding Companies employ a number of trained salesmen who are lent to such Companies as have not competent salesmen on their staff. In certain cases they take charge of the district work for such time as is necessary to reorganize the system. These salesmen are assisted in certain cases by two travelling showrooms which are the property of the Holding Companies. It is found that campaigns of this nature result in practice in a steady and continuous flow of orders for new appliances after the campaign is completed. It is found to be very beneficial to give fillip of this kind to the efforts of the local staff.

The Author explains the method of calculation whereby all subsidiary Companies' results in the sale of appliances are computed and circulated for the information of the managers. He deals briefly with the method which has been adopted by the Holding Companies of making contracts for many of the materials required by the subsidiary Companies, the arrangement being that any of the latter can requisition their requirements directly from the firms holding these contracts. He states that material economies are being made in this direction. Further, he states that the Holding Companies are continually purchasing special plant and equipment for the combined use of the subsidiary Companies. Such special equipment would normally be possessed by large companies, but could not be justified in medium and small companies. In the latter part of the Paper he outlines the basis of the charges made for the various services given by the Holding Companies. He explains at the end of his Paper that due to rising prices it has not been possible to make any reductions of importance in the price of gas, although a good deal in this direction has been done in isolated cases and in making special contracts for gas used for industrial and commercial purposes.

The Man on the Spot.

As was to be anticipated, there was no lack of speakers to the discussion on the Paper, which was opened by Colonel W. M. Carr, who is himself, of course, associated with the holding company movement. He emphasized the need for approaching the whole problem in a highly critical mood. "We must be certain," he said "that we are not placing a burden upon those whom we are trying to help which will outweigh the assistance we are able to render." Colonel Carr emphasized, too, that the most important man must always be the man on the spot, who is responsible for the working of the undertaking. He is the man who will make or mar the success of the undertaking; it is essential that his initiative should not be destroyed. Unless holding companies effect better service and supply cheaper gas, their formation cannot be justified; and those responsible for the control of holding companies must move in conjunction with, and with the goodwill of, the local managers. Colonel Carr noted that in Mr. Gill's organization there are twice as many people on the technical side as on the sales side of his staff; and this he considered to be wrong. Mr. Gill pointed out, however, that the organization was in its early stages, and it is no use launching sales campaigns if the works and distribution system are inefficient or inadequate. A supply of good gas is the first consideration.

The next speaker was Mr. P. C. Holmes Hunt, President of the National Gas Association of Australia. He explained that the Colonial Gas Association covers a distance, between its extreme eastern and its western works, of some 2,500 miles. The various works are in some instances separated by hundreds of miles, and physical linking is clearly out of the question. In Australia the holding company or the collective management is entirely responsible for the finance, and under that system the various works receive loans, charged to them at loan rates, in the amounts required by them to carry out their extensions. The holding company's control is complete; nobody else has a say in the management. As a result of his experience—and he has been associated with the Colonial Gas Association for more than 20 years—he advised those responsible for holding companies to avoid over-elaboration and too much concentration, and, above all, any stifling of the initiaitve of the local manager. Mr. F. C. Briggs observed that though the Author made a point that the holding company does not buy a gas company lock, stock, and barrel, but acquires a majority holding of its shares, this is a distinction with little practical difference. The shareholders of the holding company, through their directors, entirely control the subsidiary company and can do with it what they will. In regard to central staff, Mr. Briggs suggested that there is the danger of its becoming a body which advises, but is out of touch with daily practice and day-to-day realities. On the other hand, if the general staff of a large undertaking is made available to small neighbours, the danger disappears. This entails quite definite geographical grouping, which should be the basis of any successful holding company scheme.

Mr. C. R. Ingham gave the views of one who is an officer of a subsidiary company of a holding company. He said that in Gas Consolidation there are five gas companies within a radius of about 10 miles which are working together, quite apart from the direction of the holding company or control by its special officers. The chief officers of the undertakings hold regular meetings and discuss means whereby they can help each other; and as they are all under the control of a holding company it is much easier to work together. Under a holding company there are items of works equipment which associated undertakings can secure—oxide disintegrators, power hammers, and suchlike equipment. And, as far as the holding company with which he is associated is concerned, there is no fear of depriving the local manager of initiative or control; and there is much less red tape. "I think," concluded Mr. Ingham, "the holding companies are a perfect god-send to many small companies and to some of the larger ones." Mr. C. A. Masterman, as one reminded daily of the immense variety of technical and scientific problems which are presented in connection with the use of gas, remarked that, though the Author in his Paper refers to the technical services which the holding company can provide to the subsidiary companies in connection with manufacturing processes, on the utilization side any such service appears lacking. Mr. Masterman asked how this vital need will be accommodated. Mr. H. C. Smith observed that everything which had been said during the discussion showed that when a holding company absorbs

or controls a smaller company it immediately begins to spend more money. Where, he asked, is the money coming from? From his experience of grouping he would like to see the increasing sales from the consumer providing sufficient increased revenue to meet the extra expenditure which the holding company is going to incur in looking after the small undertaking which it is taking over. In his own instance of physical amalgamation of adjoining undertakings the savings effected in closing half-a-dozen gas-works have given something to spend on the districts of the undertakings taken over. Had it not been for those savings Mr. Smith cannot see where the necessary extra money would have been obtained. Another factor is the sources of revenue of the holding companies. These are the dividends which the individual companies they own are entitled to pay. Those dividends depend on the selling prices of gas; and the majority of the individual companies have never had their standard prices reviewed. If the standard price of a small undertaking controlled by a holding company is reviewed and increased, down goes the income of the holding company.

Future Gas Appliance Design.

THE first Paper on Thursday morning was by Mr. C. A. Masterman on "The Future of Gas Appliance Design." Before summarizing the Paper the Author took the opportunity of thanking the Secretary and Staff of the Institution for the help they had given to him as to other authors of Papers and the immense trouble they take to ensure that by the time they are printed the Papers themselves are as good—at least—as sub-editing can make them. "Having been responsible for Papers to other institutions and associations," observed Mr. Masterman, "I can say in all sincerity that the staff of the Institution is far ahead of any other with which I have worked, and I am especially glad to have this opportunity of referring to this matter on the eve of the departure from office of Mr. Alexander, to whom if I may I should like to offer my especial thanks."

Summarizing his Paper, Mr. Masterman said that expansion in the use of gas comparable with the opportunities which lie ahead can be realized only by wholehearted co-operation between the gas undertakings and the appliance manufacturers. The last ten years have shown directions in which advance in design is to be expected.

Average present annual requirements of heat for domestic purposes per household are derived as about 270 useful therms (requiring 540 therms of gas), of which gas and coke now supply nearly 40% in about equal proportion. These two fuels can offer a combined smokeless fuel service normally at a cost no higher than raw coal, a condition fulfilled by gas alone with all its attendant advantages if its increased use and the operation of special tariffs can reduce its average price by about 30%. For domestic heating purposes average-price current is non-competitive with gas on cost, while the amount of off-peak current available will always represent only a small proportion of domestic heat requirements. The displacement of coal in the home by gas and coke requires more than doubling the output of the Gas Industry, without allowing for increased demand for heat in home and factory, which must accompany improved standards of living and progress in industrial prosperity.

It must be as a service and not merely as a commodity that the future of gas is developed. Easy installation of appliances, reliability of operation, and need for minimum maintenance will all dictate changes and improvements in gas quality and in appliance design. Burners will be further developed, especially in flexibility. Appliances will benefit from the introduction of new materials in construction and fresh ideas in appearance. Water heating and space heating by gas will each develop into loads greater than the cooking load. Water heating appliances of the circulator type will displace or reinforce the coke boiler. Single-point heaters at sink and bath or small multipoint heaters will economically serve the needs of the poor, while gas installations will provide completely automatic and abundant hot water service for the well-to-do. Appliances for the home laundry will be further developed. Gas fires of improved design will serve the double purpose of heating and ventilating, but increasing appreciation of the science of comfort will lead to the development of modified or new space heating appliances. Small units for heating the air in occupied rooms as well as in halls and passages will be more generally used, often under thermostatic control. Improvements will be effected both in the general arrangement of the gas cooker and in the design of its various components. Automatic cooking machines may be developed. Other heat requirements in house or garden may increasingly be served by gas.

Appliances for the large-scale uses of gas will in many directions reflect the improvements in domestic gas appliance design and technique. Industrial appliances of other characteristics will with increasing accuracy ensure throughout the working space the required conditions of temperature and atmosphere to enable a maximum throughput of standard quality to be maintained, a requirement further assisted by the increased use of automatic feed and conveyor.

Concluding his summary, Mr. Masterman said how grateful he was to Mr. H. J. Yates, Chairman of Radiation Ltd., for consenting to open the discussion. It was very rarely that Mr. Yates could be persuaded to take part in public affairs such as this, yet he knew no one better qualified to speak on a subject such as the future of gas appliance design, in view of the immense pioneer work he had done in the past and his present immense responsibilities at the head of the biggest gas appliance organization in this country or the world.

The Gas Fire of To-Morrow.

MR. YATES, who emphasized the vital need for the closest co-operation between the supply side of the Industry and the appliance manufacturers, gave instances of the progress resulting in the past from continued research and investigation, mentioning that he established Research Laboratories over 40 years ago. As an instance of what has been accomplished by research, he cited the introduction of the "New World" cooker with "Regulo" control—a step forward which revolutionized the gas cooker. Mr. Yates recalled that the first columnar gas fire radiant was put on the market in 1908. Since that date this type of radiant had been developed and improved to such an extent that the radiant efficiency of the modern gas fire has been raised to double that of the pre-1908 fire. "I want to tell you," said Mr. Yates, "that many years ago I coined the phrase 'The radiant must go.' Perhaps in those early days it was rather an optimistic ideal; nevertheless, this conviction has grown upon me so strongly that I am prepared to make a definite prophecy by saying 'The radiant as we know it will go,' so enabling gas fires of an entirely new design to be offered to the public." In regard to improvements in appliances generally, Mr. Yates remarked that a design should only be introduced if it possesses some distinct advance in utility and construction. Changes in apparatus create great difficulties in production, particularly if the old types of apparatus are still in demand by gas undertakings, as well as the new ones. Variety of patterns adds to the cost of apparatus and reduces output.

Speaking as Chairman of the Joint Committee of the Institution and Leeds University, Mr. E. V. Evans expressed his belief that the time will come when all gas undertakings will find it desirable to ensure that the gas that is made from day to day and from hour to hour conforms to standards which are a good deal narrower than those at present considered necessary. "In the opinion of some," he observed, "it may be that the gas undertaking that I serve has too rigidly controlled the gas supply to its district by maintaining the chemical and physical characteristics within too narrow a limit. If we have done that, it is perhaps pardonable, because to-day in our district of supply difficulties concerning the performance of appliances do not arise. When an appliance fails to give full efficiency it is the appliance that is at fault, not the gas." Mr. Evans is confident that if the Research Executive Committee of the Institution is able to place before the Industry a carefully prepared case showing the absolute necessity for standardizing the chemical and physical characteristics of the gas supplied to its consumers, gas engineers and gas chemists and the designers of gas-making plant will find a way to meet that requirement.

The importance of the viewpoint of the woman as to future appliance design was stressed by Mr. Townsend, who expressed his satisfaction that Mr. Masterman had put in a good word for the storage type of water heater—an appliance with which good business has been done at Colchester. Mr. Dean Chandler, speaking of the lighting load, called attention to the fact that if we resigned the field of lighting we should make it easier for the electricity undertakings to charge a still higher rate for lighting in order to decrease their charges for the other purposes in which they are in competition with gas. We must therefore do all in our power to lay stress on the points on which gas is superior to electricity for lighting. Mr. Chandler said he had long held the view that in the case of gas oven heating the non-aerated burner would be more satisfactory than the aerated type. The South Metropolitan Gas Company has recently adopted non-

aerated gas flames in wash-coppers and large boiling pans with great advantages; and in his opinion there is no fundamental reason why this type of burner should not be used to good effect for many purposes, including the cooker hotplate, excepting, of course, the brill.

Consumer Service.

THE final Paper to be submitted at the meeting was on "Consumer Service," by Mr. R. N. LeFevre, of the Gas Light and Coke Company. Presenting the Paper, the Author remarked that the service generally given by the gas undertakings of this country is unrivalled in its quality. We proudly proclaim ourselves as "Public Servant No. 1." The unfailing regularity of the supply of our basic commodity has led us to believe our service to be the best. But the public will not let us rest at this. It demands from its gas undertakings a service considerably more extensive than it expects from any of the other public utilities.

In his Paper, continued Mr. LeFevre, he had attempted to enumerate the various technical aspects of good service to the consumer. It is generally agreed, he said, that the sale of gas, which, after all, is the ultimate aim of a gas undertaking, can only be effected and, what is more important, satisfactorily maintained, by offering to the public not gas, but a service—comfort in the home, efficiency in the factory—which, through the medium of gas appliances, can be obtained in a manner at all times safe, reliable, and economical.

The gas appliance, he went on, is thus the focus of customer satisfaction on which depends the prosperity of the gas undertaking. No matter how good the appliance, however, its efficiency may be completely nullified if it is improperly installed or if the gas supplied is of varying quality. It would not be an extravagant claim to assert that the whole science of gas engineering revolves around the burner of the appliance. It is here that consumer satisfaction and safety is established or otherwise and, since a gas undertaking's prosperity depends upon the satisfaction of its customers, it follows that all branches of its activities are purely means whereby satisfactory appliance performance may be accomplished.

A gas appliance will give such satisfaction to the customer that he will continue to use it regularly and thus become a remunerative consumer of gas only if: It is properly designed and constructed for the purpose for which it is intended; it is the correct selection for the particular circumstances for which it is required; the gas quality is controlled and consistently maintained; the distribution system is carefully controlled; the appliance is correctly installed; and it is subsequently properly serviced.

The subject in essence is thus resolved into the appliance; and its installation and maintenance, which includes the material required, the tools and equipment necessary, and, finally, but perhaps most important of all, the men to do the work.

The real backbone of customer service, continued Mr. LeFevre, is, of course, the men; and the provision of the right type of man depends not only on training, but on careful personnel selection in the first instance. As the labour side of the service given is the most expensive, so it is logical that it should be the most studied. Money cannot be over-spent if it be well spent in this connection, since the more expert the men the fewer will be the requests for service and the greater will be the reduction of complaints and of loss of business. Perfectly good appliances have been damned by incompetent installation.

While the existing Education Scheme provides the basic training for all types of service personnel, a more specialized knowledge needs to be given; and it is suggested that Regional Training Centres on the lines of Watson House might be established elsewhere in the country.

Good Fitting Essential.

DISCUSSION on the Paper was opened by Lieut.-Colonel W. French, D.S.O., M.C., Superintendent of the Department of Technology, City and Guilds of London Institute, who suggested that the time may have arrived for the Institution Education Committee to undertake a comprehensive review of the various courses and syllabuses of the Education Scheme. Mr. C. H. Rendell, of the Gas Light and Coke Company, remarked that without adequate training the advantages gained by the progress in design and construction of appliances would be in danger of being nullified by bad selling, poor installation, or poor maintenance. The effect of the training given at Watson House in recent years, he remarked, had not only materially increased the general standard of knowledge possessed by those employed on the district, but had made possible the handling of the enormous increase of business experienced in the last few years while at the same time improving the standard of service. Mr. Rendell agreed with the Author's criticism of the gas fitters' training course. "It needs revising and bringing up to date," he said, "so that it may become self-sufficient as a medium for training the young entrants to the trade of gas fitter. The present gas fitting course is good, and it has done and continues to do good work, but it could be made much better and more useful if it were re-framed in the light of all the requirements of gas fitting practice on the districts to-day."

Mr. W. L. S. Spinks mentioned that in Birmingham classes for gas fitters were established in 1899 and had been continued since that date, though, of course, they had been modified and extended. As a result the Birmingham Gas Department is in the happy position of having between 400 and 500 fitters all of whom have passed through their apprenticeship with the Department. Mr. Spinks gave details of the Birmingham scheme and emphasized that training of men, while being systematic, must be continuous and never finish. Dr. J. N. Long, Principal of the Westminster Technical Institute, spoke of the need for the fitter to undertake his work efficiently and to the satisfaction of the housewife—with due regard to the Wilton carpet and the like. The general attitude and proper deportment of the fitter are all-important to good service. Dr. Long urged undertakings which may be contemplating the establishment of schemes of training to co-operate with and seek the help of their local Directors of Education and Principals of local technical colleges. Mr. C. N. Critchley spoke of the type of man needed to occupy the position of service supervisor, who, in the Gas Light and Coke Company, has been recruited not only from men whose experience has been gained solely on the practical side, but also from the ranks of trained investigators—men whose undergraduate and post-graduate training was essentially on the principles of investigation and which was augmented subsequently by practical experience. Dr. Burness, of the Board of Education, mentioned the desirability of bearing in mind that the conditions operating in gas undertakings generally were very different from those obtaining in the Gas Light and Coke Company, and that for this reason a broad rather than a specialized training in appliances was, in general, to be preferred.

Tribute to Dr. Carpenter.

AT this stage in the proceedings the President referred to "a very great and esteemed member," Dr. Charles Carpenter, who, he thought, had done more than anybody for technical progress in the Industry. He had been very ill and was still very ill and Mr. Lacey felt they would like to send a message to him from the meeting. The suggestion to send a message of sympathy and good wishes to Dr. Carpenter was welcomed by the meeting.

Concluding Proceedings.

MR. LACEY then announced that the Autumn Research Meeting of the Institution will be held in London on Nov. 2 and 3 next, and that the 75th Annual General Meeting, also in London, will be held on May 31 and June 1, 2, and 3, 1938.

Mr. John Terrace then moved an omnibus vote of thanks to all who had contributed to the success of the meeting. In doing so he specially mentioned the Institution's gratitude to the Royal Geographical Society for the use of their building as meeting-place. He also, in view of the impending retirement of Mr. Alexander from the Secretaryship of the Institution, paid special tribute to his services to the Institution. The remarks of Mr. Terrace, of Mr. W. W. Atley, who seconded the vote, and of Mr. Alexander in reply are reported elsewhere in this issue.

Mr. H. C. Smith then proposed a vote of thanks to Mr. Stephen Lacey and presented him with the Presidential Certificate. Mr. Lacey, he said, had carried out his duties as President of the Institution thoroughly and efficiently and in a most dignified and charming manner. He had set a high example to those who would have to follow him. The vote of thanks was carried with enthusiasm, and the Presidential Certificate was presented amid prolonged applause. Mr. Lacey, replying, thanked the members of the Institution for their loyal support during his year of office and also expressed their gratitude to Mr. John Terrace for his services as Hon. Secretary. The members applauded this reference and the proceedings terminated.

The Secretary Bids Au Revoir to the Institution

J. R. W. Alexander's Retirement

At the conclusion of the meeting of The Institution of Gas Engineers on Thursday morning Mr. JOHN TERRACE, proposing an omnibus vote of thanks to all who had contributed to the success of the proceedings, made special mention of Mr. J. R. W. Alexander, who retires from the Secretaryship of the Institution this month.

Mr. TERRACE said: Mr. Alexander has been with the Institution for a comparatively short time, but if you consider the position and the condition of the Institution when he first became our Secretary, and make comparison with the position to-day, I do not think it will be necessary for me to elaborate very much on his good points. I have had the advantage of being closely connected with him all the time; although only in certain cases is it possible for a member to be closely connected with the Council and the inner working of the Institution for more than three years, by some strange interpretation of the regulations I have managed to be there continuously during the whole of Mr. Alexander's period of service to the Institution. With my previous knowledge of the work that has had to be carried out, and my knowledge of the wonderful strides which have been made in carrying on successfully the work of education and research, to say nothing of the organization that is necessary nowadays for ensuring the comfort of so large a number of members as we have attending our meetings, I am sure Mr. Alexander has rendered the Institution very excellent service. The President has mentioned in his Presidential Address that only those of us who are most closely connected with Mr. Alexander know all the details of the work he has done. But I think all will view him from the point at which they have come into contact with him, and will judge of his services in many ways. I should like to think that the many hundreds from all over the country who have, from time to time, called on Mr. Alexander, and who have been met by his cheery smile and bright remark, to say nothing of his joke, will always look back with gratitude upon the service he rendered them at the time they needed it. While we are all very sorry that Mr. Alexander is leaving the Institution, we are pleased that he is remaining in the Industry. I am sure you would like at this time to wish him every success in the new venture upon which he is embarking. (Hear, hear.)

Mr. Alexander leaves his last meeting as Secretary of the Institution.

Mr. W. W. ATLEY: I am extremely pleased to have this opportunity to second the vote of thanks to all who are mentioned. It is perhaps unnecessary to add to what has been said already with regard to the services of Mr. Alexander. But as a Regional Member of Council I receive voluminous documents from London from time to time, bearing Mr. Alexander's signature. I have many activities in my own town, of course, and it takes me all my time to read and digest the contents of those documents thoroughly; how much more time and care must be devoted to them by the man who has to prepare them and circulate them to the members of the Institution!

Mr. WALTER T. DUNN (formerly Secretary of the Institution) supported the vote.

Mr. Alexander's Reply.

Mr. ALEXANDER, responding, said: Perhaps you will allow me to give a few figures concerning the meeting, as is customary. I had not anticipated that this meeting of the Institution, which unfortunately is my last as Secretary, would produce record figures. There was a Coronation, there was a transport strike, there was a possibility of a coal strike, and there was a change of place of meeting. All those things seemed to indicate that this meeting might not be quite so largely attended as usual. I am particularly gratified, therefore, to be able to say that most of the figures are records. The actual attendance at the meeting is no less than 1,632. The attendance at the reception and dance, for the first time, I imagine, has amounted to four figures—1,046. The visits to the works and laboratories of the Gas Light and Coke Company at Fulham were spread over two days, and there was the almost spectacular attendance of 707. The attendance at the President's Luncheon was also a record; although the number had necessarily to be limited, there were more than 200 acceptances. It has been necessary also to limit the number going to Folkestone on Friday, and I have to apologize to certain members because hotel accommodation necessarily results in limitation, but the attendance will be 350. There are two other figures which will give some indication of the enormous amount of detail work the staff has to do. In connection with this meeting we have issued or printed, mostly issued, nearly 6,000 tickets, and the total number of communications printed, almost all of which were issued in connection with the meeting, approaches 14,000. Those figures give some indication of the development of the Institution in recent years, and in course of time we shall have to describe the figures, I think, as astronomical—to use a popular word.

With regard to my own personal connection with the Institution, I cannot say, as the characters in certain books said, that I have served under two flags or under three men in a boat—or should I say *with* three men in a boat? I have known only one flag during the last eight years, and that is the blue flag of the Institution; my "three men in a boat" have in fact been eight Presidents of the good ship "Institution," and two excellent pilots, Mr. W. E. Price and Mr. John Terrace. The Presidents I recall with gratification: Mr. C. S. Shapley, Mr. Harold E. Copp, Mr. J. H. Canning, Mr. Ralph E. Gibson, Mr. F. P. Tarratt, Mr. C. Valon Bennett, Colonel W. Moncrieff Carr, and Mr. Stephen Lacey. To complete the nautical allusion I might almost use the words of Charles Dibdin in "Poor Tom"—"Farewell, my trim built wherry, oars and coat and badge; farewell." I am sorry that I shall not have the privilege of serving under Mr. H. C. Smith, Mr. Robert Robertson, and Mr. George Dixon; I shall be deprived of my Tott (Tottenham) and my Scotch (a reference to Mr. Robertson) and my Notts (a reference to Mr. Dixon). I have seen in these three gentlemen a bright light on the horizon. Unfortunately, I shall not be able to serve them in the full splendour of the noon-day sun, but as an Associate of the Institution I hope to be present at the setting of the sun in the west, and I hope that the next three annual meetings will mark the terminations of

three memorable Presidential years. They for their part, on my leaving, may say as did Shakespeare in one of his sonnets, "Farewell! thou art too dear for my possession." The only fear I have about attending those meetings is that I may be privileged to speak, and probably I shall be hoist with my own petard—*i.e.*, the speakers' time indicator!

Since I have been connected with the Institution I have met with nothing but kindness from every member with whom I have come into contact. You must remember that I came to the Institution quite unknown—although, thanks to my friends of the Press, I cannot say that I was unsung. I have found the members appreciative of things accomplished and tolerant in respect of things not achieved. If I have done anything to enhance the prestige and influence and usefulness of the Institution, then I am a very happy man. Indeed, I might also adopt the words of Pericles to Aspasia—"The happy never say, have never heard said, 'Farewell'."

I should like now to commend to you my successor. (Applause.) It is no exaggeration to say that he is a good man and a true. I am sure that Dr. Braunholtz will wear successfully the Secretarial mantle (after a little adjustment of its length) which will shortly be transferred from my shoulders to his.

Those whom I go to serve have left me and will continue kindly to leave me free to render any assistance to the Institution that I may be called upon to render. Anything that I can do for the Institution as an entity or for the members individually I shall do both as a privilege and as a pleasure. That will be a pleasure always, because I should like to leave the Institution the kind of knowledge expressed in the words of Shenstone: "As sweetly she bade me farewell, I thought she bade me return."

The President's Luncheon

On Tuesday, June 1, the President entertained Members of the Institution and many distinguished Guests at Luncheon in the Ballroom of the Savoy Hotel.

The company included Mr. C. R. Allensby (President, Institution of Heating and Ventilating Engineers); Mr. R. Wilson Bartlett, J.P. (Immediate Past-President, Society of Incorporated Accountants and Auditors); Mr. C. F. Broadhead (Melbourne, Australia); Mr. J. W. Brown (Barbados); Mr. Bernard F. Browne (Santos, Brazil); Lt.-Col. F. H. Budden, M.C. (Public Relations Officer, Institution of Civil Engineers); Dr. H. H. Burness, M.C., Ph.D., H.M.I. (Board of Education); Mr. W. J. A. Butterfield (Gas Referee); Dr. H. T. Calvert, M.B.E., D.Sc., Ph.D. (Director, Water Pollution Research Division, Department of Scientific and Industrial Research); Professor A. M. Carr-Saunders, J.P., M.A. (Charles Booth Professor of Social Science, Liverpool University); Sir Reginald G. Clarry, M.P.; the Right Honourable J. R. Clynes, J.P., M.P., D.C.L.; Mr. J. O. Cooke (British Standards Institution); Dr. William Cullen, LL.D. (President, Institution of Chemical Engineers); Mr. W. A. Damon, B.Sc. (H.M. Chief Alkali Inspector, Ministry of Health); Major-General A. E. Davidson, D.S.O. (Director of Mechanization, War Office); Mr. H. O. Davies (Secretary, Association of Public Lighting Engineers); Professor A. C. G. Egerton, F.R.S., M.A. (Professor of Chemical Technology, Imperial College of Science and Technology); Dr. Margaret Fishenden, D.Sc. (Lecturer in Mechanical Engineering, Imperial College of Science and Technology); Dr. J. J. Fox, O.B.E. (the Government Chemist); Mr. A. A. Garrett, M.B.E., M.A. (Secretary, Society of Incorporated Accountants and Auditors); Dr. Ing. Immo. A. H. Glenck (German Association of Gas and Water Engineers); Mr. P. Good (Deputy-Director, British Standards Institution); Mr. A. F. P. Hayman (Past-President, Belgian Association of Gas Engineers); Mr. P. C. Holmes Hunt (President, National Gas Association of Australia, Melbourne); Mr. John Irminger, B.Sc. (President, Norwegian Gas-Works Association, Bergen); Mr. C. Isdell-Carpenter, O.B.E. (Secretary, Chartered Institute of Secretaries); Col. E. E. B. Mackintosh, D.S.O. (Director, Science Museum); Mr. H. J. Pooley (General Secretary, Society of Chemical Industry); Mr. P. C. Pope (Secretary, Institute of Fuel); Mr. J. Davidson Pratt, O.B.E. (Chairman, British Road Tar Association); Mr. J. N. Reeson (Melbourne, Australia); Mr. S. MacGregor Reid (Adelaide, Australia); Mr. James F. Ronca, O.B.E. (Director of Gas Administration, Board of Trade); Mr. P. F. Rowell (Secretary, Institution of Electrical Engineers); Mr. D. R. Wilson, C.V.O., C.B.E. (H.M. Chief Inspector of Factories, Home Office).

The Toasts.

The Loyal Toasts having been honoured,

The PRESIDENT proposed "The Guests." They were friends of the Institution, he said, helping it in one way or another, directly or indirectly. That being so, perhaps he might be excused if he said something about the function of the Institution, instead of attempting to do full justice to the Toast by individual reference to their many distinguished guests. He must, however, make three exceptions—first, Col. Mackintosh, with whose name he had the honour to couple the Toast, secondly, Prof. Carr-Saunders, and finally Sir David Milne-Watson, who was there in as many as three capacities—as Chairman of the British Gas Federation, as President of the National Gas Council, and as Governor of the Company which the President had the honour to serve. He expressed his pleasure and satisfaction at his presence and thanked him and his co-Directors for their unfailing support during his year of office as President of the Institution. Also, said the President, he was sure they would all wish to take the opportunity of congratulating Sir David upon the Baronetcy which had recently been conferred upon him by H.M. the King. [Applause.]

Those of them who were members of the Institution were not unnaturally proud of the fact that this was their 74th Annual General Meeting and that their "Transactions" recorded the activities and sayings of nearly all the pioneers and leaders of the Gas Industry. Indeed, up to 26 years ago, the Institution was the only national body in the Industry doing its best to look after its political, legal, and commercial interests, which were becoming vitally important, in addition to serving its main purpose as a professional and technical association. Realizing that this wide range of activities could not be adequately dealt with by a technical body, members of the Institution took a leading part in the formation of the B.C.G.A. and the National Gas Council, whose magnificent work for the Industry was known to them all. To-day, the Institution was one of a united team of National Bodies, each with its special function—theirs to promote technical progress and invention with every means in their power, in all branches of the Gas Industry. The increasing scope of the Institution's technical and educational work gave the title "gas engineer" a very much wider significance than it had had originally, for they had travelled far since the days when gas undertakings were almost entirely occupied with gas manufacture.

They had among their guests many who, though not members of the Institution, gave them invaluable assistance on their Research and Investigation and Education Committees and at their Meetings, and he was glad to take the opportunity of saying how greatly their generosity was appreciated.

Gas Exhibit at the Science Museum.

Before sitting down, there was one matter of importance, concerning the Institution and the Gas Industry as a whole, to which he wanted to draw their special attention. Those of them who had done him the honour of hearing his Presidential Address that morning would have learned that the technical achievements of the Gas Industry, which would bear comparison with those of any other industry in interest and importance to the community, were quite inadequately represented at the National Science Museum, and that on the invitation of the Museum Governing Body it was intended to put that right by augmenting very considerably the existing exhibits so as to tell a consecutive story of the scientific progress of the Industry from the earliest times to the present day. Everyone would agree that here was an opportunity that must not be lost, of making good an obvious deficiency in the national records of science and industry; and he felt confident that the appeal for support, which would shortly be issued by the British Gas Federation, would obtain the generous response it deserved. They were fortunate in

having with them on that occasion Col. Mackintosh, the Director of the Science Museum, who, he was glad to say, was taking a great interest in the scheme and would, he hoped, in reply to this Toast, tell them something about it from the Museum point of view.

Col. E. E. B. MACKINTOSH, D.S.O. (Director, Science Museum), commented on the very splendid and most welcome scheme of the Gas Federation to create and install in the Science Museum a permanent exhibition to the efficiency and worth of the great Gas Industry of this land. He mentioned it because The Institution of Gas Engineers was giving its very valuable and wholehearted support to the scheme and he wished to thank the President and the Institution for their share in that great work. It was not a pretty thought that one of the country's great activities was hardly represented at all in the National Museum of science in industry; unfortunately, where there should be gas there was almost a vacuum! But there were two exhibits which he mentioned specially. One was a very fine model of a gas-works, presented to the Museum by the Gas Light and Coke Company, and it had been one of his first tasks, as Director of the Museum, to accept the model at Horseferry Road. The occasion had been doubly pleasing to him because Sir David Milne-Watson was a very dear friend of his, and it was so nice to meet with human sympathy. The other exhibit was a portrait of a pioneer, Samuel Clegg, which occupied an honoured place in the Council Room at the Museum. Those two bright gas jets had to keep gas burning in the Science Museum until the new scheme burst forth in all its brilliance. About one and a quarter million people of all ages visited the Museum each year, a fact which indicated the trend of modern interest and proved that a Museum of that type was worth while.

The scheme of the Gas Federation was the first instance in this country of one of our great industries taking complete charge of its own section at the Museum. He was truly and deeply grateful for that very public-spirited action and for the very fine example it would set for the other industries of the nation.

"The Institution."

Prof. A. M. CARR-SAUNDERS, proposing "The Institution," said the very fact that the Institution had spent so much time, money, and energy in education and research activities disproved the charge that was very often made against professional bodies, that they were self-regarding and monopolistic. The object of research was to make the industry or profession of greater service to the public, and education was also a public service. One reason why he was particularly glad to be present as a guest of the President was that the engineering industry and the engineering associations, almost more than any others in the professional field, had co-operated with the universities. Such co-operation was more rare than should be the case, and many associations in this country were somehow without the ambit of the universities. It was a special pleasure to propose the health of The Institution of Gas Engineers, which was established in 1863. To be 74 years old was to be venerable in the world of professional associations; he believed the Institution was the fourth in order of birth among the engineering institutions.

Mr. H. C. SMITH (President-Elect), whose name was coupled with the Toast, was received with applause on rising to respond. Referring to the book which Professor Carr-Saunders had written with regard to the professions, he said that on reading it he had been horrified to find the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects, and the Institution of Electrical Engineers were described as the *big four*. Perhaps, at any rate during Derby week, they might be referred to as "the odds-on favourites." Professor Carr-Saunders had stated that, generally speaking, those bodies stood more or less on an equality as leaders in their own sections of the field, and that the membership of each was large. But, said Mr. Smith, the Gas Industry had gone far beyond judging the quality or efficiency of a body by its size. They wanted efficiency as well as quantity, quality as well as numbers. Then Professor Carr-Saunders had mentioned the Institution as among the junior institutions. Of course, after hearing Professor Carr-Saunders propose the Toast of the Institution, members would look forward to a second edition of his book in the near future! However, it was only fair to say that there was a collaborator in the writing of the book, and no doubt the collaborator was responsible for the slight errors referred to! But the position of The Institution of Gas Engineers had been well established in the Loyal Address to H.M. King George VI. on the occasion of his Coronation. In that Address the order of the signatories—and that established the order of importance—was the Institution of Civil Engineers (1818), the Institution of Mechanical Engineers (1847), the Institution of Naval Architects (1860) The Institution of Gas Engineers (1863), the Royal Aeronautical Society (1866), the Iron and Steel Institute (1869), and the Institution of Electrical Engineers (1871).

It was interesting to compare the work of the Institution to-day with its work in the year of the Coronation of King George V. In 1911, Mr. Alexander Wilson, of Glasgow, was President. The number of Members, Associate Members, and Associates was 865, as compared with 1,649 at the end of 1936. A little while ago Mr. Smith had read that a sign of the fact that the Institution was seeing the light was that its President this year was engaged in the sales side of the Industry; that had rather suggested that in the past the Institution had considered only gas manufacture. But the "Proceedings" of the Institution belied that. In 1911, for instance, there was a Paper on "Modernizing a Medium-Sized Undertaking," by Mr. C. F. Broadhead, of Middleton—and at this 1937 Annual Meeting a Paper was presented by Mr. C. F. Broadhead, of Melbourne, a striking coincidence. Another Paper in 1911 was entitled "Aspects of Gas Supply in a South American City," by Bernard F. Browne. Another was "The Dessau Vertical Retorts at Sunderland," by Charles Dru Drury, of Sunderland. Others were "The Choice of a Carbonizing System," by P. C. Holmes Hunt, of Melbourne; "Public Lighting," by S. B. Langlands, of Glasgow; "The Woodall-Duckham System of Vertical Retorts," by J. P. Leather, of Burnley; "Notes on Corrosion of Service Pipes," by James McLeod, of Greenock; "The Scientific Carbonization of Coal," by J. G. Newbigging; "The Uses of High-Pressure Gas for Industrial Heating," by Dr. E. W. Smith; and there was a lecture on "Surface Combustion," by Professor W. A. Bone. Even a little more than 25 years ago, therefore, the members of the Institution were thinking of the future and were not confining their attention wholly to manufacturing problems. In 1911 also the Institution was entertained to luncheon by the Corporation in City Chambers, Glasgow, and to a reception and dance. In that year also the Institution was considering the education and certification of gas fitters and a report on the subject was laid before the members; it was considering an exhibition which was held in 1913; and it had supported the International Smoke Abatement Exhibition during 1911. Further, it was considering a Standard Specification for Street Lighting, in conjunction with the Institution of Electrical Engineers and other bodies; Mr. Robert Watson was one of the Institution's representatives on the Specification Committee at that time, but the views of the Institution were in the minority. A Re-constitution Committee of the Institution was set up in 1911 to consider alterations to the By-Laws to provide for more enthusiastic propaganda; but as the B.C.G.A. was then formed, under the auspices of the Institution, no further action by the Institution was considered necessary.

Those facts, concluded Mr. Smith, gave an idea how far advanced were those responsible for the conduct of the Institution 25 years ago. Since that time the Institution had advanced further, as it would continue to do.

A Modest Omission.

Sir DAVID MILNE-WATSON, Bart., D.L., LL.D. (Chairman, British Gas Federation), proposed the health of the President of the Institution, Mr. Stephen Lacey, although the Toast was not on the official toast list—an omission which Sir David attributed to Mr. Lacey's characteristic modesty. Sir David reminded those present that Mr. Lacey represented a very old gas family. His father had been in the employment of the Gas Light and Coke Company, and his brother is at present on the staff of the Company. Sir David also thanked Mr. Lacey for the many suggestions he had made in his Presidential Address. It was always of interest to hear the views expressed by officers of the Company at such meetings; he might or might not agree with them, but it was just as well to see how they were setting their faces! [Laughter.] One particular suggestion made by Mr. Lacey, and which Sir David pressed upon the attention of the Gas Industry as a whole, was that the Institution should not try to set up a central organization of its own for research work, but should take over the direction of research work, which work should be carried out in the works and laboratories of the various gas undertakings. He would leave it with those who were in control of the affairs of the Institution, that that was the right way in which to carry on research in the Gas Industry in the future.

In Mr. Lacey, concluded Sir David, the Institution had a most competent Chairman and President, who was upholding the dignity of the Gas Industry in every way.

The PRESIDENT, in returning his thanks for the generous manner in which the Toast had been proposed and received, assured all present that it had been a great pleasure to entertain to luncheon so many good friends.

PRESIDENTIAL ADDRESS

OF

STEPHEN LACEY, B.Sc.

(Controller of Gas Sales to the Gas Light and Coke Company).

In the first place I wish to thank my fellow members for the privilege of serving the Institution as President during the year that will come to an end with the close of this Meeting, and to acknowledge gratefully the generous help and encouragement received from all quarters. I am naturally proud of the honour of being the first member to be elected President whose experience as a Gas Engineer has been obtained on the distribution and utilization side of the Industry. At the same time, I hope I may fairly claim to be sufficiently familiar with gas manufacture and with the administrative and commercial problems of Gas Undertakings to appreciate the interdependence of manufacture, distribution, and utilization, and to see the work of the Institution in proper relation to that of the other national bodies. The opening of Gas Industry House, an outstanding event of the year, not only provides greatly improved accommodation for the complementary gas associations thus brought together under one roof, but stands also as striking evidence of the Gas Industry's solidarity and unity of purpose. Members will be glad to know that the Institution's new headquarters have been found to suit our requirements admirably; and I hope that those who have not already paid them a visit may find an opportunity of doing so during the course of this Meeting.

Pioneers of the Eighteen Sixties.

When considering the present and future work of the Institution in relation to its historical background I looked up the first volume of our Transactions, which contains the fascinating record of the first seven Meetings of the Institution's progenitor, the British Association of Gas Managers, from its foundation in 1863. My attention was chiefly arrested by the proceedings of the Third Annual Meeting held at Manchester in May, 1866—just over 71 years ago—when the first President of the Association, Mr. Thomas Hawksley, an engineer of wide experience and international reputation, occupied the Chair for the third consecutive year. Needless to say, the state of development and circumstances of the Gas Industry at that time differed greatly from those of to-day. That I was prepared for, but what I was surprised to find was a clear statement of the proper function of a national technical body and a far-sighted recognition of the future of gas as a fuel, at a time when it held a virtual monopoly as an illuminant. I think you may be interested if I quote a few significant passages from Mr. Hawksley's address and from a lecture that was delivered on the same evening by the distinguished chemist, Dr. Letheby:

> "Everyone is now convinced," said Mr. Hawksley, "that this association is one from which benefit will be derived both in respect to the manufacture of the peculiar article which it is the duty of the gas engineer to provide for use of the community, and also as to the best modes in which that article can be distributed to the community at the smallest expense and with the greatest amount of utility. . . ."

Again:

> "We can ascertain by research what are our deficiencies; we can ascertain by investigation the means for remedying these deficiencies; and I think during the last year our time has not altogether been misspent with regard to the attainment of these objects."

Later Mr. Hawksley referred to the possibility of bringing "the quantity of sulphur in the gas down to 2 grains per 100 cu.ft.," and finally, when speaking of the lecture to be given by Dr. Letheby, entitled "On the Combustion of Gas for Economic Purposes," he urged the members to pursue the methods that Dr. Letheby would point out and to make "experiments and investigations" to "test the accuracy, sufficiency, and general applicability of other methods."

Dr. Letheby's lecture is well worth reading to-day, especially the latter part, which was clearly intended to rouse interest in the potentialities of gas as a fuel for industrial and domestic purposes. He demonstrated how the temperature of burning gas could be increased by mixing "a sufficient quantity of air with the gas before it reached the place of combustion," the air being drawn in by the gas passing from an orifice or blown in under pressure as in a blowpipe. He showed how even higher temperatures could be obtained by employing oxygen instead of air, and described furnaces used by Johnson Matthey and Company, the platinum assayers of Hatton Garden. He then gave what he called the "thermotic power" (in British Thermal Units) of the gases constituting "common" and "cannel" coal gas, and showed that the calculated thermotic powers of these two mixtures of gas were respectively 650 and 760 B.Th.U. per cubic foot.

Regarding the use of gas as a fuel for domestic purposes, and after calculating the amount of gas theoretically required for providing a hot bath, he said:

> "In practice, however, this is rarely attained, because of the faulty construction of the heating apparatus. I find, indeed, that a bath in my own house, made by Phillips, of Skinner Street, takes nearly twice this proportion of gas to heat it, and being in a closed room the atmosphere is almost poisoned before the bath is ready; and the circulation of the hot water is so imperfect that the top layer becomes boiling hot before the bottom of the water is warm. This is a subject which requires attention, for it is open to much improvement." And later: "When the heat of gas is required for warming a room, its radiant power should be increased by allowing it to ignite some solid substance, for the radiant heat of a non-luminous flame is very insignificant."

Thus, as far back as 1866, we find engineer and chemist together advocating a policy of research and investigation and indicating the future of gas as a fuel in terms which are appropriate to-day, although, in the meantime, conditions in the Gas Industry and in the world at large have changed almost beyond recognition.

Function and Membership.

It would appear, in retrospect, that the Gas Industry was slow in taking advantage of so far-sighted a lead—though it is easy to be wise after the event, and to do justice to our predecessors one must have in mind all the circumstances of their times. The chief retarding factor, no doubt, was the lack of sufficient incentive to pay very much attention to the technique of the utilization of gas as a fuel so long as it held the virtual monopoly in lighting and an increasing demand could be largely taken for granted. But be that as it may, our practical interest in the extracts I have quoted lies in the attention they draw to the essential character and wide scope of the Institution's present-day function as the only national technical body in the Gas Industry.

For many years the Institution was primarily a professional body of Gas Engineers (in what was the generally accepted but somewhat limited sense of the term), its great influence being in part due to the managerial responsibilities of the majority of its members.

The development of the complementary national bodies during the last 25 years, while relieving the Institution of special responsibilities with regard to administration and commercial affairs, has, at the same time, greatly increased the scope of its responsibilities for scientific technique and development and education in all branches of the Gas Industry. The Institution is fully alive to this, and shows itself as willing and anxious to enlist the services of all who can contribute to its work, whether Gas Engineers in the traditional sense of the word or not, and whether members of the Institution or not. The membership of the many Committees of the Institution is chosen solely on the basis of qualification to deal with the subject matter of the particular Committee. And at the meetings of the Institution, which provide a platform for a wide variety of subjects, contributions by experts outside the Institution are welcomed.

It will be appropriate if I say a few words at this point about the present and future membership of the Institution. Since the granting of the Royal Charter the number of members has increased from 1,405 in the year 1929 to 1,649 in the year 1936. This may be considered as a satisfactory increase, especially having regard to the

higher standard of technical qualifications required by the Charter By-laws, but many would like to see an increase of members engaged on the supply side of the Gas Industry in view of the greatly increased importance now attaching to the technical aspects of distribution and utilization.

Also it is thought that the membership should include the scientific specialists who now contribute so much to the development of the Industry on its technical side, provided that such men have a broad training and experience in addition to their specialized knowledge.

The Council's proposals for the amendment of the By-laws governing admittance to the Institution, with the object of securing the election of all men adequately qualified technically, will come before the Members for approval during this Meeting.

The Market for Smokeless Fuels.

The principles underlying research and investigation are not confined to what may be called fundamental scientific research, but are applicable to all kinds of applied research whether in a scholastic sense scientific, or not. Such work is vitally important to industrial development under modern conditions. For example, the need for the correlation of facts on which commercial policy should be based has given rise to market and statistical research, in regard to which there is much yet to be done for the Gas Industry to ensure that time, energy, and money are spent to the best advantage and the best use made of the scientific research with which the Institution is primarily concerned.

The starting point of market research in the Gas Industry must clearly be a statement giving the community's present demand for heat in homes and factories and the extent to which that demand is met by the various fuels available. Such a statement with regard to the annual domestic heat requirements will be found in a Paper entitled " The Future of Gas Appliance Design " to be presented by Mr. C. A. Masterman during the course of this Meeting. From it I have extracted the following figures mainly to indicate what progress the Gas Industry has made as a supplier of smokeless fuel up to date, and how great is the field that remains to be cultivated.

The total domestic heat requirements (including cooking, water heating, and space heating) per head of population are shown to be met at present by the supply of 334 therms per annum, of which coal is responsible for 72·0 per cent., smokeless solid fuels 18·5 per cent., gas 7·6 per cent., kerosene and fuel oil 1·6 per cent., and electricity 0·3 per cent. And by taking into account the efficiencies of utilization of the different fuels, the useful heat per head of population per annum is estimated to be 67·5 therms, accounted for by coal 53·2 per cent., smokeless solid fuel 23·1 per cent., gas 18·8 per cent., oil 3·7 per cent., and electricity 1·2 per cent.

The outstanding fact in this statement, from the national standpoint, is that even now, over two-thirds of the heat supplied for domestic use is in the form of raw coal which, by common consent, is deplorable in view of the consequent waste of the nation's fuel resources and of the damage to the health and property of the community as a whole. In this regard, the suppliers of home produced smokeless fuels have the satisfaction in common that their own advantage is happily in accord with the public interest; and this consideration might very well have more influence than sometimes appears to be the case in preventing competition from being carried to wasteful extremes.

It is natural that the versatility of electricity in the service of the community should give a false impression of its actual achievement and economic possibilities in the field of heating. I do not propose to argue the matter at length here, but to point out that, notwithstanding the greatly increased output of electricity during the last twelve years, the increase in gas consumption during that period is equivalent to 2½ times the whole of the electricity now used for domestic heating of all kinds. Further, to be at all competitive, electricity for heating has to be offered at a price per unit that is such a small fraction of the corresponding price for lighting that the heating load must be " carried " by the lighting load; and in some districts the position has already been reached when further increase in the heating load must increase the " peak " and reduce the " load factor "—an unenviable state of affairs when load factor has such a great bearing on cost of supply.

I am not suggesting that the Gas Industry can afford to ignore electrical competition in the heating or any other field. On the contrary, competition must continue to be met at every point. But a proper sense of proportion should be maintained, and it must always be borne in mind that the great opportunities for our Industry will be found not by fastening our eyes on our competitors in the smokeless fuel market, but by looking towards the two great fields of expansion still awaiting us, one in the further replacement of existing uses of coal, the other in meeting that increased demand for fuel which will accompany a rise in the standard of living.

It would appear that we are at last approaching the time when the burning of crude coal for domestic heating will be generally recognized as a relic of the past, imposing an unnecessary burden of work, dirt, and ill-health on the individual as well as being wasteful from the national point of view. It must be our task to hasten this recognition, and to offer practical alternatives in terms of gas and coke to the great majority, if not all, of the present modes of domestic coal consumption. Progress on these lines calls for detailed market research, constructive planning and the employment of modern selling and publicity methods in contact with the public we serve.

Incidentally, I may say that the Gas Industry has the Electrical Industry to thank for leading the way in the introduction of promotional tariffs, by which the commodity is sold at a rate substantially below the average price after the individual customer has paid his share of the standing charges. Experience of many Gas Undertakings has shown that such tariffs are essential to the further development of the sale of gas to an extent at all commensurate with the opportunities in the smokeless fuel market.

On the other hand, there are still many Gas Undertakings which have not yet seen their way to make any considerable departure from the flat rate method of charge. I am aware, of course, of the practical difficulties that have to be faced where the present flat rate is such as to provide little or no margin to cover the estimated loss of revenue that would immediately result from giving an advantage to existing " good consumers." Nevertheless, there can be no doubt that the new methods of charge must come sooner or later. All Statutory Gas Undertakings now have the necessary powers under the Gas Undertakings Act, 1934, and it is satisfactory to note that the Joint Committee of the House of Lords and the House of Commons on Gas Prices, in its Report of this year, fully recognized the unsuitability of the flat rate method of charge in the highly competitive conditions that now prevail.

One of the major problems of the Gas Industry is how to maintain proper economic balance between the production and sale of gas and gas coke, which are at one and the same time complementary and in competition with one another—a problem greatly complicated by the erratic demand for and supply of oven cokes, although produced primarily for the heavy industries.

Gas is the ideal fuel, and we should look forward to the time when the use of solid fuel of any kind will be a thing of the past. But no good would come of burking the fact that until gas can be sold at a lower average price than at present, the demand for smokeless solid fuels in place of coal will continue, and should be encouraged. There is nothing inconsistent, therefore, in striving for the ideal of complete gasification of coal and, in the meantime, doing everything possible to increase the market value of gas coke by technical improvements in coke and coke burning appliances, and by the application of sales methods not less enterprising and intelligent than those applied to the sale of gas.

The Institution's Research Work.

In past years the work of the Research Staff of the Institution has been principally concerned with investigations in regard to current problems and processes, as for example the efficiency of gas heating, corrosion of metals by products of combustion of gas, manufacture of carburetted water gas, and the disposal of Gas Works liquors.

The last year, however, has seen the initiation of investigations more fundamental in character and concerning more particularly the future of Gas Manufacture and Utilization. The examination of likely trends in the development of methods of producing and using gas to satisfy the changing requirements of modern standards of health and comfort is essentially a matter in which the Institution can and should be of great assistance to the Gas Industry.

The composition of gas is variable within the limits

imposed by a declared calorific value and a constant performance of the appliances in which it is used; and Gas Undertakings should clearly be in a position to take the fullest advantage of such variability in relation to fluctuating markets for the raw material and by-products. It is with this in view that investigations are being made by the Institution, both of new processes of manufacture and of the possibility of modifying gas burner design to afford a maximum flexibility in burners.

As a first step in the direction of increased burner flexibility, it is necessary to establish some criterion whereby the behaviour of any given gas mixture in an appliance can be assessed, and this important problem is being investigated by the Institution, by certain Gas Undertakings, and by the first Arthur Duckham Research Fellow, working under Professor Dr. K. Bunte at the Gasinstitut, Karlsruhe.

In considering probable developments in the process of manufacturing town gas, we must attempt to visualize the requirements of the public ten, twenty or more years hence. As I have already indicated, there are many persons who consider that in spite of the present expanding market for domestic coke, which is likely to be accentuated if current experiments on coke activation prove commercially successful, the requirements of the householder and flat-dweller will gradually change and that ultimately the inconveniences and labour attaching to the use of even the cleanest solid fuel will not be tolerated. Gas and electricity would then become the two staple sources of domestic heat, light and power, both ashless and on tap.

If this vision be true, the Gas Undertaking of the future will be concerned with the production from its raw fuel of the maximum quantity of gas, and processes of complete gasification will be installed for this purpose. Such processes have hitherto suffered from the disadvantage of producing gas of a relatively low calorific value, but entirely new possibilities are opened up by the discovery that considerable quantities of methane are formed if the gasification process is operated under pressure and by admission to the generator of oxygen instead of air. The use of oxygen in complete gasification was first brought to the notice of the Institution in a Paper read by Professor Cobb and Mr. H. J. Hodsman at the Annual General Meeting of the Institution in 1920, and it is, therefore, specially appropriate that the investigation of the possibilities of the combined use of oxygen and pressure should be under the supervision of the Joint Research Committee of the Institution and the University of Leeds. The collaboration of the Fuel Research Board in the work is an important and welcome innovation.

At this point I would like to mention the admirable Paper by Mr. C. F. Broadhead, of Melbourne, entitled "The Consolidation of Gas," which will be under discussion at this Meeting, and in the course of which he describes the conditions that specially favour the development of complete gasification in Australia and of the technical progress that is being made.

Other new processes and technical developments are under review by the Research Executive Committee, which is also planning to establish even closer collaboration than in the past with other research organizations, in this country and abroad, and thereby, at relatively little additional expense, greatly to enlarge its field of investigation.

The most fruitful research in relation to expense is not necessarily obtained by the maintenance by the Institution of a permanent Research Staff, and the time may come when, to a greater extent than in the past, the Institution may decide to make grants for particular items of research to be carried out, with definite terms of reference, in such laboratories within or without the Gas Industry as may seem most capable of producing the best results.

The benefits derived from the close connection between the Institution and the British Refractories Research Association over a long period of years are too well known to you to need elaboration. I will confine myself in this connection to offering to Mr. A. T. Green our congratulations on his appointment as Director of Research to the Association in succession to Dr. J. W. Mellor, who becomes its first President.

A great deal of valuable research has been, and is being, carried out by Gas Undertakings and by manufacturers of plant and appliances. It is the function of the Institution to encourage such work; to prevent wasteful overlapping as far as possible; and to aim at bringing the results of the work to the attention of the technical workers of the Industry in such a way that the fullest use can be made of it.

Following recommendations by the Research Executive Committee, which have been accepted by your Council, developments have already proceeded to some extent on the lines indicated and will necessitate some addition to the Technical Staff at Headquarters in the near future.

7th Autumn Research Meeting.

The 7th Autumn Research Meeting held last November was outstanding from the point of view of the size of the attendance, the very topical interest of the subjects discussed and the high quality of the Reports, Papers and Discussions.

I would remind you, for example, of the practical contribution towards the elimination of sulphur compounds from gas, which I hope stimulated very many Gas Undertakings, in their own interest and in that of the Gas Industry generally, to give effect to the recommendation that sulphur compounds should be reduced, as they can be reduced, at least to a maximum content of 10 grains per 100 cu.ft.

In this connection I should like to call attention to a report published by the Royal College of Physicians in December, 1936, on "Domestic Heating by Gas considered from the point of view of Health and Comfort." The Report has a very important bearing on the further development of the Gas Industry in regard to the use of flueless heaters for domestic heating, and every member of the Institution should be familiar with its contents and findings.

I would remind you further of the comprehensive Paper dealing with the mechanism and prevention of gum formation in gas, a problem which had become of acute practical importance in some areas, and of the 3rd Report of the Gasholder Committee, containing the Voluntary Rules of the Institution for Inspection and Maintenance of different types of Gasholder, together with an appeal to all Gas Undertakings to adopt and carry out regularly the recommendations set forth. Although inspection and maintenance of water-sealed Gasholders have, since last November, been introduced specifically into the Factories Bill at present before the House of Commons, observance of the Rules of the Institution would more than comply with the Bill.

Rising Standards of Purity and Uniformity.

In recent years the demands made on the utilization side of the Gas Industry have made it necessary to ask the manufacturing side for increasingly purified and standardized gas. Naphthalene, water, rust, sulphur and gum have been or are being dealt with by Gas Undertakings striving to perfect technical service to their customers. Troubles associated with variations in pressure are being overcome by the increasing use of appliance and/or service governors.

Attention is now being focussed upon the need for limiting variations in the combustion characteristics of the gas supplied. I have already referred to this in my remarks on research. The practical considerations involved are dealt with in Papers presented at this Meeting by Mr. Stewart and Mr. Masterman, from the manufacture and utilization points of view respectively.

Another important question that will come up for discussion in this connection is the practicability of reducing the range of calorific values declared by the Gas Undertakings of this country.

Complementary to the questions of closer standardization of gas are those concerned with the design, installation and maintenance of appliances considered in relation to the essential background of training and testing. All these questions are raised in one or more of the Papers presented at this Meeting, and they will be seen to be so closely related as to form parts of the same vitally important problem, *i.e.*, how to give the best possible service at a reasonable cost.

Industrial Gas Centres.

It may seem that one very fruitful technical activity lies outside the authority of The Institution of Gas Engineers. I refer to the Industrial Gas Development Scheme, which has now been operating for over two years. Considerable progress has been made both in establishing co-operative relationship between the Gas Undertakings and the industrial contractors and also, in an educational direction, in creating throughout the Industry a better understanding of the industrial market and industrial technique. Some years must elapse before this Scheme bears its full fruit. So far as the Institution through its Research Executive Committee is able to assist in the matter, its services are at the disposal of the Industrial Gas Centres Committee or of the Joint Co-Ordinating Committee of the National Gas Council, the British Commercial Gas Association and the Institution, to which it is responsible. Problems

which come before the industrial specialists involve not technical considerations alone, but commercial negotiations and other matters not strictly the responsibility of the Institution, and for this reason the Joint Co-Ordinating Committee appears to be the appropriate body to give general supervision to the Scheme. Ultimately, its degree of success will depend upon the men who are operating it and their contacts with their own Managers and other responsible officials, so that the particular label under which they fulfil their function is of much less importance than the personal contact and co-operation which is allowed to develop.

So far as problems arise of common interest to all of us in the Gas Industry—and most problems which do arise are of common interest—so far should there be every facility for co-operation between all those concerned.

My own Company bears a two-fold special responsibility: on the one hand on account of its size and on the other hand on account of its situation at the capital of the Empire. On neither ground do we claim any degree of perfection: often we can learn with advantage from other Undertakings: always we are willing to give all the help we can in return.

Watson House.

Many of you will, I hope, be visiting Watson House during the course of this Meeting, and will observe how the Gas Light and Coke Company is tackling some of the problems connected with the consumer. You will see the development of industrial technique, which is closely linked up through the Industrial Centres with work going on all over the country; the increasing extent to which not only the Company's staff but also members of the staff from our larger consumers and from outside Gas Undertakings are passing through various courses of training. Also the laboratory research and the contacts which have been established between these laboratories and technical work going on all over the world to provide a background for appliance design, for testing and for the provision of a better service of heat to the community. In doing this research and development work for themselves the Company is inevitably doing it also for the Gas Industry as a whole; and duplication of this effort, so far as it is of general application, would be wasteful of energy and prohibitive in cost. At the same time it will be understood that the facilities of Watson House in no way diminish the importance of an increasing technical staff elsewhere and the provision of an increasing number of laboratories operating up and down the country, to which in the long run it is hoped every single Undertaking, however small, may have access.

Grouping of Gas Undertakings.

While co-operation between existing Gas Undertakings is all to the good and ought to be encouraged in every possible way, keeping pace with the times involves a degree of specialization which is only possible in organizations on a fairly large scale, and for that and other reasons the grouping of Undertakings by one means or another should be welcomed. It is to be hoped that in the development of Holding Companies the advantages of grouping on a regional basis will be borne in mind; and also that we shall not see a form of competition within the Gas Industry which, in the long run, might reduce rather than increase its power to meet competition with other industries.

The Institution's special concern with the Holding Company movement is the beneficial effect on technical control and development that the grouping of Undertakings makes possible. One of the Papers to be discussed during this Meeting deals with this subject of topical interest.

National Defence Problems.

In a world in which all the major nations are spending fabulous sums on armaments and defensive measures, Great Britain has been reluctantly compelled also to direct a portion of her wealth and energy into similar non-productive channels. New problems have been presented, of prime importance amongst which is the assurance in time of national emergency of an uninterrupted supply of the vital necessities of the community. Gas Undertakings are asked to plan with a view to safeguarding the supply of gas during enemy attack and a new Committee, the Gas Works Safety Rules Committee, has been set up by the Institution to consider the technical aspects of this problem and other matters relating to the safe operation of Gas Works.

Unfortunately, the means proposed for securing continuity of gas supplies involve the installation of additional plant which, in normal times, would be of no practical value to the Gas Undertaking. The Gas Industry, therefore, whilst wishing to collaborate to the utmost, not unnaturally expects that the cost incurred in carrying out such schemes of National Defence should be borne nationally, *i.e.*, by the Government.

The National Gas Council at the request of the Home Office has recently set up a National Committee to represent the Industry in these matters.

The question of maintaining street lighting during aerial attack has for some time been exercising the minds of the Home Office, with whom the Institution has been in contact on the subject. Although no definite policy has so far been formulated by the Home Office, it has been widely assumed that some form of instantaneous extinction of street lamps may be required.

Methods of effecting such extinction of gas street lamps have been and are being reviewed and tested by the Joint Lighting Committee, which has compiled a short memorandum on the subject for the guidance of Gas Undertakings seeking assistance. It is important to remember, in view of exaggerated claims that have been made, that such difficulties as may be involved in installing mechanism for effecting instantaneous extinction are by no means confined to street lighting by gas.

The Science Museum.

In his Presidential Address last year Colonel Carr referred to efforts which were being made to provide a permanent Exhibition of an historical and educational nature in the form of a Gas Engineering Section at the National Science Museum at South Kensington. I hope those of you who are not already familiar with the contents of that unique and wonderful institution, which was inaugurated here in South Kensington following the Great Exhibition of 1851, will take the opportunity of doing so during this Meeting.

A Gas Engineering Section had its place there along with the other main branches of engineering until the new buildings were brought into use in 1927. And then, as the gas exhibit was out of date, no new additions having been made since 1892, the existing models were relegated to the basement to leave room for up-to-date exhibits of the electrical, radio and other industries.

On the invitation of the Governing Body of the Museum, on which the Gas Industry is represented by Mr. T. Hardie, it is intended that the existing models and other exhibits comprising this Section shall in the near future be considerably augmented and housed in a prominent position in the main building, and an appeal will be issued by the British Gas Federation for contributions to a fund to defray the cost of this work and for gifts of models, drawings, &c., dealing with both gas manufacture and utilization, of historical and educational interest.

This is a great opportunity which must not be neglected. The Gas Engineering profession has a fascinating story to tell, and I suggest that to respond to the appeal liberally is a duty laid on all who are in any way associated with this great Industry.

Resignation of the Secretary.

Members will have learnt with real regret of the impending resignation of Mr. J. R. W. Alexander as Secretary of the Institution, an office which he has occupied with conspicuous ability during the last seven years. Coming to the Institution in the year in which the Royal Charter was granted, and with no previous experience of the Gas Industry, he made himself familiar with the affairs of the Institution in a surprisingly short time and applied himself to every detail of its work with characteristic energy and efficiency.

While his work at Headquarters can only be fully appreciated by the Presidents and Members of the Council and Committees with whom he has constant contact, the whole of the members cannot fail to have been impressed by his courteous service at all times and his admirable organization of the Institution's work in general and of its General Meetings and social functions in particular.

I am glad to record the Institution's appreciation of his work and its satisfaction in the knowledge that he will continue to serve the Gas Industry in the new and responsible positions to which he has been appointed.

As the members will be aware, the Council has appointed Dr. W. T. K. Braunholtz to the position of Secretary to the Institution. He has exceptionally high academic

qualifications, considerable experience in the direction of research, and with his two and a half years' experience as Technical Assistant Secretary to the Institution, during which period he has worked in close collaboration with the Secretary, he will, I am confident, prove to be a worthy successor this month to Mr. Alexander.

The duties of the President of The Institution of Gas Engineers occupy a considerable amount of time, and I acknowledge with gratitude the indulgence in this respect of the Governor and Directors of the Gas Light and Coke Company and the co-operation and assistance of my colleagues and staff.

GENERAL MEETING OF CONTRIBUTORS TO

The Institution Benevolent Fund

A General Meeting of the Contributors to the Benevolent Fund of The Institution of Gas Engineers was held in the Hall of the Royal Geographical Society on Wednesday, June 2, 1937—the PRESIDENT (Mr. Stephen Lacey) in the Chair.

The HON. SECRETARY (Mr. J. R. W. Alexander) read the notice convening the meeting.

The minutes of the general meeting of contributors, held in London on May 27, 1936, were taken as read and were confirmed and signed.

The PRESIDENT moved that the Report of the Committee of Management of the Benevolent Fund for the year 1936-37 and the Accounts for the year 1935, which had been printed and circulated to contributors, be taken as read and adopted.

Mr. H. C. SMITH seconded.

Mr. WALTER T. DUNN (late Secretary of the Institution and late Hon. Secretary of the Benevolent Fund) expressed appreciation of the work of the Committee of Management, as evidenced by the Annual Report. He also paid tribute to the Hon. Secretary, Mr. Alexander, and said that since he had held that office the subscriptions and donations had increased materially; and recalled the efforts of Mr. Bennett, which had resulted in a large accretion to the Fund. Having been Hon. Secretary of the Fund over a period of 32 years, he knew something of the distressing cases that had been assisted, and he congratulated the Committee of Management on having been able to help a large number of people, at the same time sympathizing with them in the fact that they were not able to give more than they had given.

Means to Augment the Fund.

Dealing with means by which the Benevolent Fund might be augmented, Mr. Dunn suggested that when a man was elected to membership of the Institution, in any grade, a letter might be sent to him by the Hon. Secretary of the Fund suggesting that he might be disposed to mark the occasion by contributing one guinea to the Fund; and a form could be enclosed, to be filled in by the new member if he contributed. Mr. Dunn suggested that when a man was elected to membership of the Institution he would experience the flush of achievement and was ready to consider all the obligations of membership. It was was not suggested that at that stage a member should be asked to promise an annual contribution; but it was likely that a man who contributed in the first place would subsequently get into the habit of contributing. There was no question of coercion. Mr. Dunn also suggested that when a member of the Institution was first elected to the Council (which was a great honour) he might be invited to contribute two guineas, that a newly-elected Vice-President might be asked to contribute three guineas, and that a newly-elected President might be invited to subscribe five or even ten guineas. Another suggestion he made was that the Committee of Management might with advantage be enlarged, thus creating a wider circle of influence, and that the rule governing the election of the Committee might be revised to enable that to be done.

(The resolution for the adoption of the Report of the Committee of Management for 1936-37 and the Accounts for the year 1936 was carried.)

The report of the scrutineers on the result of the ballot for elections to the Committee of Management for 1937-40 showed that Mr. W. H. Bennett and Mr. B. R. Parkinson had been elected.

Average Contribution.

Sir FREDERICK J. WEST, C.B.E., J.P., proposed a hearty vote of thanks to the Chairman, the Committee of Management, and the Hon. Secretary of the Benevolent Fund, and took the opportunity to draw attention to one of two features in connection with the Fund which were not revealed in the report. A survey covering a period of eight years, he said, revealed that in 1929 the Institution had 1,405 members, of whom 518 had contributed £554 to the Fund, an average of slightly over £1 per contributor. In 1936 the membership of the Institution had grown to 1,650, of whom 943 contributed £715, which was an average of slightly over 15s. per contributor. In 1929, 63% of the members did not contribute, and in 1936, 44% did not contribute. While he welcomed the satisfactory increase in the number of contributors, he urged that during the next few years the 44%, representing the members who did not contribute, should be considerably reduced. In 1929 the Fund had distributed to 15 recipients a sum of £540, and in 1936 it had distributed to 27 recipients a sum of £773. In 1937 it was proposed to distribute £807, according to the budget. Analysis of the accounts showed that the income from contributors was not sufficient to meet expenditure, and it was due only to the generosity of older members and those who had made bequests that it had been possible to accumulate a fund from which to draw the balance. In 1936 the Fund received £400, the proceeds of the W. E. Price Presentation Fund; and in 1937 it had received a total of £155 towards the Coronation Fund, 15% of that £155 being recurring. That indicated a satisfactory development in connection with Coronation year.

Perhaps the most trenchant statement in the report of the Committee of Management was that the amounts of the grants in most cases did not adequately alleviate the distress of the recipients. While the members of the Institution, he said, were proud of the Institution's development and the increase in its membership and rejoiced in its increasing influence and importance, he asked them to ensure that its benevolent work, which was very necessary, should in no way be neglected.

A Privilege to Help the Unfortunate.

Mr. R. J. H. CLARK, seconding, said that unfortunately some members of the Institution, in common with all humanity, fell by the wayside and were in need of assistance; they, and their dependants particularly, suffered great hardship. It was or should be the privilege of the membership generally to put aside some of that which, fortunately, they were able to earn, for the purpose of helping those less fortunately placed. He pleaded that those who were not yet subscribers should subscribe, and that those who were subscribing relatively small amounts should try to increase those amounts, because the benevolent work of the Institution was of the greatest importance. The heartiest thanks of the membership were due to the Chairman, the Management Committee, and particularly the Hon. Secretary of the Benevolent Fund for their good work.

(The vote of thanks was carried with enthusiasm.)

The PRESIDENT briefly made acknowledgment on behalf of all concerned, and the meeting closed.

DISCUSSIONS ON THE PAPERS

Summaries and Abstracts of the Papers appeared in our First Institution Number on May 26, and the following are full reports of the Discussions which took place upon them. Papers and Discussions are summarized on earlier pages of this issue in our Review of the Proceedings, which gives the consecutive story of the whole Meeting.

The Consolidation of Gas

Communication No. 153

by
C. F. BROADHEAD
(Engineer, Metropolitan Gas Company of Melbourne, Australia)

Dr. E. W. Smith, C.B.E.: I can assure you, as one who has just come back from Melbourne, that in Australia they are just as advanced and just as progressive and they are doing just as much work as, if not more than, the average gas undertakings in this country in the development of their Industry. I visited every large gas undertaking in Australia, and I was astounded by the amount of progressive work that is being carried on. Whether it be in connection with fundamental research, the regulation of sulphur in gas, the purifiers or the gasholders, or increasing the efficiencies of water heaters, or dealing with tar or anything else, there are undertakings in Australia spending a great deal of money and doing a great deal of very valuable work; and that work is being co-ordinated very well to-day. Mr. Broadhead is justified in being proud of the enormous revolution that he has brought about in Melbourne during recent years. His undertaking is one of the most progressive in the world to-day, and his pride in it is justified.

One difficulty which Mr. Broadhead experiences—and which is shared by many people in this country—is that he cannot understand why the Gas Industry is not gas-minded. They define a gas-minded person as one who knows nothing about anything but gas and one who is not to be interested in anything else but the selling of gas. They are probably right. But that does not mean that a man interested in gas believes merely in selling gas at any price. The petroleum industry does not confine itself solely to the production of petrol; it does not crack everything to petrol, and it would not pay if it produced nothing but petrol. Obviously it can produce the cheapest petrol from its raw materials by selling as many intermediate products as possible at as high a price as possible. That is the sort of thing we have to do to-day in England in order to produce cheap gas. In my view the Gas Industry will have to supply for many years to come an alternative to coal in the form of coke. You have only to consider, as has been pointed out in recent times by Dr. Sinnatt, that if 65 per cent. of the families in this country depend on incomes of less than £3 per week, and 85 per cent. depend on incomes of less than £5 per week, those people cannot afford to waste a shilling per week extra in paying for something that is costing them more than they would pay if they continued to use either coal or coke. If you look through the consumption figures you will find that, in spite of the industrial loads and in spite of the quite good consumptions in some of the better-class houses—which constitute a very small proportion of the total, only about 3 per cent., I think—the big consumptions come from large numbers of poor consumers, not small consumers, but poor consumers. It is by endeavouring to persuade the poor consumer to increase his consumption a little that we shall increase the consumption of gas a lot. The poor domestic consumer must continue to use coal unless we can give him a satisfactory coke; and there is no reason why we should not give him a satisfactory coke to-day, as indeed we are in many places. It is not a question of competition between gas and coke, but of competition between coke and coal. Nowadays we are using 35 million tons of coal per annum domestically, and we have less than 4 million tons of coke per annum available for sale for domestic purposes. It is that small inroad into the use of coal that we have to make by the selling of coke.

Complete Gasification.

Then we come to the major question of complete gasification, which has a bearing on the coke situation. I do not think there will be any trouble as regards coke markets for 10 or 20 years from now; I mean that we shall always be able to sell coke at such a price as will not justify the complete gasification scheme, which latter means the utilization of coke on the works. That is my view; I do not see any evidence contrary to it. But I believe that complete gasification is coming and has to be watched very carefully, and it has to be developed as quickly as possible to-day. I believe Mr. Broadhead has the only practical complete gasification process that is available to the Industry anywhere in the world. Anyone who has studied the subject of complete gasification knows that it should be capable of dealing with coking or non-coking coals; it is not essential, but it is better that it should be so. In normal complete gasification processes that have been tried in the past, or at any rate in most of them, there are two or three main troubles. One is that volatile matter is lost during the blow period, and that is wasteful; another is that coking coals cake, and it is difficult to get those coals to flow through the plant. Then the plants are very often intermittent, and it is necessary to use a holder. Mr. Broadhead has overcome all those difficulties in an ingenious way. We know that when a coking coal is subjected to heat, and at a comparatively low temperature, it becomes a non-coking coal. That is what happens in his plant. If you can pass the volatile matter of the coal through the coke bed under controlled temperature conditions you get very good cracking and the hydrocarbons and tars are all converted into gas. That is what he is doing. His process is continuous. Having had the opportunity of studying it in great detail over a period of days, I should like to congratulate him publicly upon a really valuable technical achievement.

The next question is, what is its place in the Industry? I believe its place is as an alternative to semi-carburetted water gas. For very good reasons we are going to continue to use water gas in the Industry. It is fundamental that we should be able to maintain constant characteristics of gas, whatever those constant characteristics may be, as standards set by the Institution in the future. We have got to continue to develop along lines that will enable us to maintain, with the greatest flexibility, constant characteristics independently of load. Water gas, when used correctly, is in my view the main assistant in enabling the Industry to maintain constant characteristics

in gas. A water gas from coal is complete gasification gas.

Use of Non-Coking Coal.

Another point, and one of great interest for the future, will be the necessity for the Gas Industry to use non-coking coal. The use of complete gasification plant is the only means for the Gas Industry, other than by blending, of using non-coking coal, and I really believe that in this country there ought to be for black coals a big development in the use of complete gasification processes in the future.

Most of the points that Mr. Broadhead makes in his Paper, and on which he rightly dogmatized, are points relating to the peculiar conditions in Melbourne. Although he thinks that we in this country will ultimately follow the lead of Melbourne, where they feel that they have to eliminate the production of coke, tar, and the like, I believe it is possible that, just as evolution operates in this country, evolution will operate in Melbourne, and that there will be changes in other directions in Melbourne which will enable Mr. Broadhead in the future, producing an improved coke, to sell a great deal more coke than at present. No doubt he will tell me that I am talking through my hat. But he tells us in the Paper that at Yallourn they produce the brown coal briquettes, which offer such serious competition to Mr. Broadhead's coke in Melbourne. I am not sure, but I think it is accepted that the station at Yallourn is not likely to be extended in size, for I understand that it has reached its economic limit. If that be the case, and bearing in mind that the brown coal mined is being used partly to produce electricity and partly to produce briquettes, then as the demand for electricity and the quantity produced is increased, the proportion of briquettes which have to be made will be reduced. So it is quite conceivable that at some time in the future there may not be so large a quantity of briquettes coming into Mr. Broadhead's coke market. All kinds of things can happen and might assist Mr. Broadhead, in spite of himself, in getting matters into proper focus. Also I think there is a possibility that in time he will be able to sell his tar in competition with bitumen and petroleum products for the roads, although the conditions in Melbourne are very different from those obtaining here.

Sulphur Elimination.

With regard to the elimination of sulphur from gas, so far as I am aware Mr. Broadhead is one of the first Britishers actually to make any attempt to treat gas at the retort house along refrigeration lines, though it has been done to some extent in Germany. I believe that is one of the directions in which the Industry has left a great deal undone that it should have done in the past—the development in a comprehensive way of the treatment of crude gas after the retort house. If benzole recovery is to be popular in this country it is vital that refrigeration methods should be developed for the treatment of gas. A few days ago I took out some figures in comparing different methods of sulphur recovery from gas. I cannot accept that 10 grains or 8 grains is low enough finally. It is all to the good to reduce sulphur as much as possible in the present plant; ultimately it should be 1 grain or less. In some, but not all, of the methods possible for taking sulphur out of gas, wash oil can be used in enhanced quantities, probably up to 400 or 450 gallons per ton of coal, at ordinary temperatures and pressures. Under those conditions you take out all the benzole—you could do it with a great deal less wash oil—and all, or practically all, the sulphur. With 140 gallons of wash oil per ton, at 3° C. and at ordinary pressures, you can get the same results. (These figures are all approximate.) On the other hand, at 2 atmospheres pressure and with a comparatively small quantity of wash oil you can also obtain the same results, still doing a great deal more than you need do for taking the benzole out, but taking the sulphur out also. The refrigeration method, by the way, is much the cheaper method; it is much cheaper to use a small refrigerating plant and to cool the wash oil to 3° or 4° than to deal with all the gas at a high pressure or to circulate, say, 400 gallons of oil. There are problems, such as the thickening of the wash oil, which will have to be overcome, but they can be overcome. I do believe that Mr. Broadhead will help us here quite a lot if he will continue his work on refrigeration and will let us know what he is doing.

While in Australia I was very much impressed by the intense desire there for the most complete collaboration possible with associations in this country. Those in the Gas Industry in Australia have a lot to contribute, and they appreciate everything published from this side. The closer the collaboration and the closer the inter-communication between individuals and associations, the better it will be for both countries.

Mr. R. W. Hunter (Gas Light and Coke Company): It is stimulating to study this record of vigorous action, taken over a number of years, by the Metropolitan Gas Company of Melbourne and the bold policy outlined for the future to meet the special conditions obtaining in that great City. It seems clear that the circumstances in that Undertaking differ considerably from our own even in normal times, and much more so in the present somewhat hectic boom in industry in this country.

Most of us will agree, I think, with Mr. Broadhead in stressing the importance of cheap gas for the future to meet the fierce competition of State-encouraged electricity, oil, and coal, and coke brought into our district of supply from the collieries and their coking plants. To this end, many undertakings, and particularly my own Company, have steadily pursued a policy of remodelling and re-equipping their works during the last 20 to 30 years. Those of us who have been fortunate enough to modernize our equipment in this way during the lean years have cause to be thankful that our need for such work is at a minimum now that supplies of engineering materials are difficult to obtain and prices are soaring.

In the details given by Mr. Broadhead of the savings effected by the remodelling of his coal unloading plant and the provision of suitable ships, I can find a parallel in our own experience. At Beckton, for example, the coal unloading plant, on somewhat similar lines to that at Melbourne, was inaugurated 11 years ago and has dealt with coal up to 2 million tons per annum ever since with savings in cost per ton comparable with those quoted by the Author. A similar plant on a smaller scale at our Fulham Works enables us to convey coal by belts right into the retort house with an even greater saving in cost. Here, the unloading of ships and conveyance to the retort houses amounts to approximately 4½d. per ton of coal (including wear and tear).

Reduction of Labour Costs.

The steady progress also in the mechanization of our manufacturing stations, coupled with the utilization of waste heat and the more efficient generation and distribution of power, have had a great influence on the reduction of labour costs—*e.g.*, at Beckton, when I first knew it 35 years ago, there were something like 6,000 men employed per day on the maximum load, whereas to-day the number is less than half and the capacity of the works double. On the other hand, of course, competition has called for so great an expansion of the sales organization and service to the consumers that the number of employees at the present time is greater than ever before in the history of the Company. Coupled with these labour-saving devices has been a very important improvement in the efficiency of manufacturing processes, particularly carbonizing. We have in our various works examples of most of the type of carbonizing plants, including large installations of continuous vertical retorts, intermittent verticals, coke ovens, and horizontal retorts. We have not considered it necessary to abandon the latter, but have given great attention to the design of settings, the quality of silica and other refractory materials, and the equipment and control of temperature and gas conditions. As a result we are obtaining approximately 74 therms per ton of coal in straight carbonizing of Durham coal in horizontal retorts, with gas of approximately 540 B.Th.U. per cu.ft., which is afterwards treated for benzole extraction. In our vertical installations where steaming is practised, there is a corresponding increase in the therm yield and 78 to 80 therms of 500 B.Th.U. gas are obtained where certain Yorkshire coals are in use. We have, of course, nothing in this country to compare with the Maitland coal to which Mr. Broadhead refers. His figures of 90 therms of 600 B.Th.U. gas per ton of coal and good coke must read like a pleasant dream to members of the Beckton carbonizing staff.

With regard to coke, there is evidently a wide difference between our conditions and those in Melbourne. Here we have a constantly growing demand for coke for commercial and domestic use, coupled with an insistence upon careful preparation, including cleaning and division into a number of clear-cut grades. The cost of this preparation is considerable and I agree that it is arguable that coke does not always bear its proper share of carbonizing cost.

Value of C.W.G. Plant.

My Company were, I think, pioneers in introducing carburetted water gas plants to this country, and we have had for many years a powerful equipment of this type of plant. This has enabled us at various periods to relieve the coke market of as much as 350,000 tons per annum.

This assistance in maintaining economic prices in the market has, of course, benefited all undertakings whether equipped with water gas or not. The C.W.G. plant has been of the greatest assistance to us, particularly in times of emergency, such as the stoppage of coal supplies in 1926 when for many months we operated at least 40% C.W.G. in the mixture.

At the present time the demand for graded coke exceeds the supply and the manufacture of carburetted water gas has been cut down to a minimum. It is recognized, however, that the present conditions are quite abnormal owing mainly to the rearmament programme. I realize also in view of considerations which will be put before the meeting in Papers to be read later, that such latitude may not be politic in the future. The point I would make, however, is that so long as there is this increasing demand for graded coke, which may continue so long as the British public retain their affection for open fires and for individual household establishments, there is not with us the same attraction as for Mr. Broadhead in the complete gasification process. Any failure to supply the coke demanded would mean business lost by the substitution of raw coal, with consequent adverse effect upon the London atmosphere. The ability to produce coke of the type demanded in its district is, with us, an important factor in the overall profits of a manufacturing Station.

With regard to purification, it is interesting to follow Mr. Broadhead's recommendation for the introduction of the tower type of purifier. We have considered this for our own use, and in any case where economy of space is of first importance we would probably adopt it, but hitherto the figures I have had available appear to indicate that in our circumstances the capital cost would be higher as compared with normal boxes erected at ground level. At some of our works we find these very cheap to charge and discharge with the aid of cranes, especially where we have established a central house for the disintegration and aeration of purifying material.

It will be interesting to follow the further experience at Melbourne with the intense cooling process and its possible effects upon sulphur compound and gum-forming constituents. In our own case, as I think has been made clear in other communications, we have adopted gas-drying throughout our undertaking. We have brought about a reduction of sulphur compounds in a large proportion of our gas by means of either the activated carbon benzole plant or a modified method of oil-washing plant designed by our chemical staff, the reduction being 70% down to approximately 8 grains per 100 cu.ft. I was interested in Mr. Broadhead's reference to trouble developing through evolution of sulphuretted hydrogen from gasholder water and his means of dealing with it. We have experienced some trouble of the kind since the removal of naphthalene from the gas which formerly acted as a bactericide in the holder water. I wonder whether in this case the impurity had been communicated to the gas to such an extent as to cause trouble with the test papers, as has been the case in our experience. The various measures we have adopted for rendering the water innocuous have been referred to elsewhere by Mr. Hollings.

Negatived by Experience in Great Britain.

Mr. T. CARMICHAEL (Portsmouth): It is my opinion that the general reason for the consolidation described therein, involving more or less complete gasification—viz., the decline *allowed* to occur in the value of coke—seems to be entirely negatived by experience in Great Britain. (I use the word "allowed" designedly.) We all know that the coke has a very important bearing on the cost of the therm. The statement that the present position in Melbourne has been brought about by the demand for a more convenient fuel than coke, and for which the public is prepared to pay an enhanced price, is contrary to experience here, and I should like to ask whether Mr. Broadhead has developed coke cutting and grading in the Metropolitan Gas Company. Such development as has been effected by the namesake Company in London and by undertakings constituting the London and Counties Coke Association and similar organizations in Britain would seem to deny the statement made by Mr. Broadhead in condemnation of coke. In this country we are gas-minded and coke-minded, not merely coke-minded; gas comes first, and coke second. As Dr. Smith has said, that will be the case for many years to come.

The competition of brown coal briquettes, manufactured and marketed by the State Electricity Commission near Melbourne, could surely have been met by the sale of cut and graded coke; we should have no doubt about the result in that case. I suggest that the lost coke consumption arising from the conversion of the cable trains to electric power propulsion, mentioned in the Paper, might still be retained partly by the extra breeze resulting from the cutting and grading of coke. In the absence of information as to the prices obtained for the briquettes, and their composition and calorific value, we cannot make actual comparisons, and it would be of advantage to have that information.

With regard to tar, conditions similar to those outlined in the Paper are developing in this country, so that we are in sympathy with Mr. Broadhead in regard to that matter and congratulate him on his handling of the situation.

Apparently Mr. Broadhead's experience with silica refractories has been unfortunate, and the line of least resistance—*i.e.*, to reduce temperatures—has been followed. We should all be interested to learn in due course the results of the use of the local refractories described. Such costly experience may be partly responsible for the enthusiasm evinced for carburetted water gas plant, as in this country the reverse comparable costs are generally found. Indeed, in a Paper which I had the honour to present to the Southern Association of Gas Engineers and Managers in 1922 it was proved conclusively that, with coke at normal prices, coal gas is the more economical to make. That position was stated again in a Paper before this Institution in 1927, and it is the position to-day.

Ingenious Experiments.

The research experiments in complete gasification are ingenious. It is assumed that the costs given have been deduced for larger size plants, for otherwise they seem too good to be true! The working of the proposed half-million cu.ft. per day plant will be watched with interest.

The comparative prices charged for electricity and gas in Melbourne, as given in the Sales section of the Paper, seem to indicate that gas is at a disadvantage in this respect, compared with conditions in this country. From published information, Melbourne, as the second largest undertaking in Australasia, sells gas at a price corresponding to its size, but at approximately double the price charged in Great Britain, whereas the price of electricity there seems to be only about 50 per cent. higher than here. Of course, that must render the competition more severe, and any consolidation or development of gas will have to be approached accordingly. On this account the sections of the Paper dealing with wet and dry purification, gasholders, meter and constructional shops, seem to me to be susceptible to criticism, unless it is definitely proved more economical to adopt the method described, not merely more convenient. In connection with the tower purifiers, I would like to know the expected life of the steel plate oxide containers and extensions.

The introductory paragraph in the "Sale of Gas" section may be somewhat misleading. Recent statements regarding the manufacturing and sales sides of the Industry merely point out that the latter may have lagged behind the former, due to concentration on the manufacturing side. In the second paragraph of the "Sale of Gas" section it is stated that, with few exceptions, the most energetic sales organizations are of too recent origin to have had much effect up to the present on the position of the Gas Industry. I do not agree. Undoubtedly recent sales organizations in this country have maintained gas consumption, whereas without such effort appreciable reductions must have been registered. The Melbourne scale of charges as set out in the Paper seems simple, except in so far as the rendering of an account is concerned, because from one to six prices may apply to one account. Has "therm" charging been considered?

Mr. BROADHEAD intimated that he would reply to the discussion in writing.

CHANGING INFLUENCES in Gas Manufacture

Communication No. 155

by
E. G. STEWART
(Assistant Chief Engineer, Gas Light and Coke Company)

An Opportune Contribution.

Mr. T. CAMPBELL FINLAYSON (Woodall-Duckham Companies): The Author has made a valuable and opportune contribution by forcing our attention to be directed on this problem of gas quality and at the same time showing us the extent to which improvements in gas quality may tend to take away some of the flexibility in gas manufacturing methods. It is therefore of prime importance that we should understand—as Mr. Stewart puts it—" the *changing* influences in gas manufacture."

It seems to me that these influences come into two quite distinct groups. First, changes which are brought about for the purpose of improving gas quality—or as the Author states—consumer service. Under this heading come such features as naphthalene, water vapour, and sulphur removal, the standardization of calorific values, and regular characteristics of gas supplied. Secondly, changes which are brought about for the purposes of improving and stabilizing the economics of gas manufacture. Under this heading come such features as benzole washing, improved coke markets, and so on.

Mr. Stewart forecasts that in the not too distant future a few standardized calorific values may be adopted throughout the country. Mention is made that 450, 475, and 500 B.Th.U. gas should be acceptable to makers of 90% of the total gas sold. He further forecasts that the removal of organic sulphur from gas should and will be widely adopted. Both these trends are logical and progressive. Upon these questions of standardization of calorific value and sulphur removal I would like to make three observations:

First, declared calorific value if standardized must bear some relationship to the type of coal most easily obtainable in any given area. In fact, it does so to-day. As we come south from Scotland to the English Channel there is a definite tendency for the calorific value of gas to rise. This is obviously because the leaner Scottish coals lend themselves to processes involving steaming of the charges, whereas the seaborne Durham coals used in the south of England lend themselves more particularly to processes producing high calorific value gas.

Secondly, I would remind you that one of the most active and promising fields in carbonization research to-day is the establishment of what may be termed " controlled cracking." This is no new conception—it goes back to William Young—and has aptly been defined by Mr. E. V. Evans in 1928 as the " carefully controlled cracking of hydrocarbons in the presence of hydrogen." As you know, there are to-day three or four processes in commercial practice both in this country and abroad which depend for their high yields of gaseous therms upon the enrichment of nascent water gas by the hydrocarbon products of coal distillation. The higher the calorific value of the gas required, the less is it possible to introduce water gas into the distillation gases and consequently the less the possibility of taking advantage of such enrichment processes. The whole of the difference between declared calorific value and the calorific value of blue water gas is supplied by the hydrocarbon enrichers. With tendencies for higher coal costs it may prove desirable to conserve and increase the production of these enrichers.

Thirdly, it should be remembered that one of the most valuable of these enrichers is benzole. Can we forecast whether it will always in the future pay to extract benzole or whether it may at times and in certain circumstances pay to leave the benzole in the gas? Mr. Stewart expresses surprise that benzole recovery is not practised throughout the Industry. He is, of course, speaking from an Undertaking using a coal which naturally tends to give a gas of very high calorific value and he is, to quote a phrase of Mr. F. B. Richards, using it to slim a " fat " therm. But would he find the decision quite so clear if he was dealing with a coal that tended to give a lower calorific value gas? I suggest that benzole recovery—omitting any question of national policy—cannot be regarded as being on such a sure foundation as, say, the sale of gas itself. Benzole recovery is substantially protected by the present taxation on imported spirit and it involves the production of more coke per therm of gas made. Without in any way questioning the economic and national soundness of benzole recovery at the moment, a question I would like to ask Mr. Stewart is this. Taking the long view, is it wise to make a fundamental improvement like the removal of organic sulphur dependent upon the removal of benzole from the gas? Might not the time come when with a public accustomed to sulphur-free gas it would be necessary to extract benzole purely for the sulphur removal stage.

An Alternative Process of Sulphur Removal.

One wonders whether it is not desirable for the Industry to secure during the next few years some alternative process of sulphur removal which does not necessitate such a substantial stripping of the enrichers from the gas.

These three observations give support to a view expressed in Mr. Stewart's conclusions. In our proper desire to up-grade the intrinsic qualities of gas to the consumer we must see to it that we do not put any stumbling blocks in the path of production of cheap gas. I am sure that Mr. Stewart will agree that particularly as regards standardization of declared calorific values most careful consideration of all aspects will be necessary before any standards can be set up. Present standards may also require modification in view of changing influences.

A further conclusion from these observations is that in view of the difficulty of forecasting the trend in the near future it is of advantage to have types of plant capable of producing gas within a wide range of calorific value.

The Author's views on coke sales are encouraging. One would like to support his plea for the necessity of co-operation with the coke oven industry in the exploitation of the industrial and domestic markets. With their opportunity of producing high quality coke from washed small coals in large output plants the coke oven producers are in a favourable position. In view of Mr. Stewart's suggestion that a regular percentage of water gas should be a component of the gas of the future, may it not be fair to say that the stability of the coke market will become not only desirable, but *essential*, and in order to secure this, co-operation with other coke producers cannot be ignored.

The one problem to which Mr. Stewart cannot find an answer is how to meet a peak load without altering the characteristics of gas. He commends carburetted water gas for its rapid availability and low capital costs, but he does not like the sudden disturbance of gas quality. Among alternative methods he has, no doubt, filed away the possibility of operating a carbonizing plant under steaming conditions making gas of required calorific value, then when peak load arises bringing coal throughputs and calorific values of the coal gas up to the maximum and diluting with blue water gas made externally. This method of meeting increased gas load appears to have the advantage of maintaining regular characteristics of gas, but, of course, is not so economical in capital cost as C.W.G.

Difficulty of Meeting Alteration in Demand.

Mr. W. W. TOWNSEND (Colchester): Mr. Stewart emphasizes the importance of limiting variations in specific gravity and combustion characteristics, and he shows the difficulty of meeting alterations in the demand for gas, and at the same time complying with these requirements. He states that " where benzole extraction is practised and/or water gas is used for load balancing, the likely range of gravities is, therefore, subject to considerable variation unless a definite effort is made to control it." He adds that " limits of, say, 0·4-0·5 can be maintained, but any narrowing becomes increasingly difficult."

At Colchester we have the conditions described—namely, horizontal retorts, extraction of benzole, and water gas plant. We have for several years past worked to a dual standard, that is, calorific value and specific gravity, and

we have entered every day the Wobbé Index, which is referred to in the Paper, and is the factor $\frac{C.V.}{\sqrt{Sp.\ Gr.}}$. In addition we have recently kept records of the readings taken from a burner constructed on the Ott principle. We have managed to achieve a very fair measure of success in maintaining a gas of standard quality, and at the same time meeting the fluctuations in demand. One thing which has helped in this direction is light steaming of the charges in the horizontal retorts. Normally we steam to the extent of about 3 per cent., we extract two gallons of benzole, we add blue water gas to the extent of 17 per cent. of the mixture, and comply with our declared calorific value of 470 B.Th.U. Our storage is ample, being equal to the maximum day's output, and as the output is seldom equal to that of a given number of settings, we have one bed of retorts on and off throughout the winter—that is to say, it may work for a week or a fortnight, and then be on slow fire for several days. Mr. Stewart has pointed out the disadvantage of this procedure, but for the sake of uniformity in the quality of the gas the price must be paid in one form or another.

To return to the part played by steaming, I must explain that it is not sufficient to have a small amount of carbonizing plant under fire in excess of the average requirements, and the heating load has now reached such proportions that a sudden drop in temperature occasions increases in the demand for gas which have to be met by increasing the percentage of water gas separately manufactured. In such cases we cease the steaming of the charges, and in that way counteract the change in the specific gravity which would otherwise occur. We also at times shut off the benzole extraction plant or lightly carburet the water gas. By these methods we have been able to obtain the following results. I give the figures for the month of January last which are typical.

Maximum percentage blue water gas 21·6.

Minimum percentage blue water gas 8·3.

The greatest increase in consumption in 24 hours 16 per cent. compared with previous day.

The calorific value throughout the month was constant within ± 2·73 per cent.

The specific gravity varied between 0·485 and 0·51 or within ± 6 per cent.

The Wobbé Index was constant within ± 3·11 per cent.

The readings taken with the pseudo " Ott " burner were constant within ± 2·1 per cent.

The inerts in the mixed gas averaged 13·7 per cent.

Mr. Stewart alludes to the advantage of drying the gas on the outlet of the holders. This has been our practice since July, 1934, and we have not found any difficulty in operating the plant in this position. The washer used is of the static type, and the pressure absorption at peak load is about $\frac{1}{2}$ in.

We have a boosting plant which has been used to increase the pressure thrown by the holders during peak loads or when the holders are low. The boosters have not been used more since the installation of the gas-drying plant than they were previously. With regard to gum trouble, this is very slight, although I cannot claim that it is non-existent. Recent tests show no measurable amount.

Dr. Harold Hartley (Radiation Limited): At recent meetings of this Institution there have been opportunities of drawing attention to the sulphur question, and in 1933 I proposed that the Industry should adopt the slogan " Sulphur must go." Assuming that, with one notable exception, no endeavours were being made at that time to lessen the sulphur content of gas, it may be felt there are signs of progress. However, even to-day Mr. Stewart estimates that only some 25,000 million cu.ft. of coal gas are treated annually in London, and of this I imagine the South Metropolitan Gas Company account for some 10,000 million.

Throughout the whole country apparently less than 10% of the coal gas supplied is treated for sulphur removal, so that outside London only some 7,000 million cu.ft. are treated annually, yet the yearly make of gas by the Industry is, in round figures, some 320,000 million cu.ft. It is essential that those responsible for gas making tackle seriously this job of sulphur removal.

The Author suggests that five calorific values might be standardized throughout the country. I am sure those concerned with the making of appliances will hope that it may be possible to reduce this five to not more than three. At some of the recent meetings of members of the Industry it has been suggested that it would be advantageous if all appliances could be supplied with fixed orifice injectors. Will you please consider what it would mean to the gas appliance manufacturers even if they had to legislate for three types of nipple for each injector they supplied. If, in addition, each of the gases within the three C.V. ranges varies considerably in composition and density, other complications will arise, and hinder further the adoption of the fixed orifice.

Table 3, in which the Author gives compositions of four gases of 500 B.Th.U. per cu.ft. gross C.V. with densities varying between 0·4 and 0·67, would be more complete if he were to indicate (*a*) the amount of carbon dioxide and steam produced on complete combustion, (*b*) the amount of air required for the burning of each cu.ft. of the gas; and I suggest this information be included. If, in addition, the Author can give curves showing the flame speeds at different aerations calculated from the dimensions of the inner cones of a bunsen burner, these would be helpful.

It is our experience that the maintenance of a given A.T.B. number does not ensure that the same combustion results will be attained with an appliance, and more work will need to be done before the ideal test burner becomes available.

Density Variations.

It is suggested that density variations over a range of, say, 0·40-0·50 must be accepted as reasonable. For a given gas fire burner system showing an air-gas ratio of 3·0 with a gas of density 0·45, it can be computed that the air-gas ratio with a gas of density 0·4 would be 2·9, while with a density of 0·5 this would be 3·08. If the air-gas ratio were to vary as the square root of the density, as seems to be suggested in Figure 1, the corresponding ratios would be 2·84 and 3·15 respectively. However, I do not think a square root density rule applies. Now a change in the air-gas ratio from 2·9 to 3·08 would mean a decrease in cone height of about 20% on the basis of the flame speed curve for a typical London gas, a difference which might be very significant in regard to the ability to satisfy the present-day combustion standards. The ratio between the primary air and the gas streaming through the burner has a most important influence on the combustion standard attained in all classes of apparatus for which bunsen burners are used, a fact which is to be anticipated from consideration of the composition of the inter-conal gases.

In Figure 1 there is used the expression " Intrinsic Flame Velocity Curve of Gas." I am not clear as to what the Author means by this phrase. Flame speeds recorded during the so-called " uniform velocity phase " are dependent on the conditions under which the gas is burnt, a fact which his expression does not seem to take into account.

I would like to take this opportunity of drawing attention to the inadequacy of the statistics in this country relating to the Gas Industry, in comparison, for example, with those available in America, or even for the competitive electrical industry. Appliance makers do feel the need for much more technical information regarding gas supplies than is given by a mere statement of the calorific value. Information as to the density and composition, the air required for complete combustion, and the carbon dioxide and steam produced during burning would be helpful. On the Continent there is available at least one form of apparatus which enables a flame speed curve to be plotted quite simply. The general production of such curves might with advantage be considered by the larger concerns.

Further, it would be helpful if more information were available regarding the utilization of gas. There is much need for market research, although perhaps this is not a subject with which this Institution will deal.

In his concluding section, the Author rightly draws attention to the need for co-ordination of policy. This need seems to be marked in all phases of the Industry's activities. It is becoming more and more obvious that we shall not make satisfactory progress, from the technical point of view, until we have frequent meetings of technicians concerned with both the manufacture and utilization of gas, with frank discussions of their difficulties, and limitations of knowledge. At present, matters of technical policy are sometimes settled without adequate discussion by the whole of the Industry, and although it may be contended that each gas undertaking is an individual, it must not be forgotten that the actions, certainly of the larger undertakings, may have wide repercussions, and if, perchance, any one of them were to make a mistake, the effects might not be limited to the confines of the area of supply of that undertaking.

There may be an improvement if, and when, this Institution extends its membership, but we shall not make full progress until we have a completely democratic Institute, embracing all members of the Industry with technical interests. The need for co-operative effort by

the technical people of the manufacturing side, and the appliance design side, is most strikingly emphasized by the Author.

No doubt, at the November meeting, we shall hear something of the work that Mr. Wood has been doing during the last year, and that may give an opportunity for a discussion of the effect of the various factors which influence the performance of gas appliances.

It would help if the reprints of Papers could be made available at least three weeks before the meeting. I should also like to plead for a limitation of the length of reports; they should not be longer than the present communication. Voluminous Papers defeat the aim of the Authors, because few have time to read them.

Experience at Halifax.

Mr. W. B. McLusky (Halifax): My reason for appearing here is that about a month ago I suggested the lines on which the Gas Industry might be developed during the next 25 years. My first point was clean coal; the second was centralization of manufacture where commercially advantageous, and the working together of the rural undertakings—*i.e.*, co-operation—the third was the development of liquid purification on the lines suggested by William Young and the late Thomas Holgate; the fourth was the standardization of flame volume and calorific value; and the fifth was the linking of mains between towns adjacent to each other and the development of gas supply in the rural areas between. I feel very complimented to note that those points which I had merely adumbrated have been so exhaustively set out in Mr. Stewart's Paper.

Taking the points in the order in which they appear in the Paper, the coal must be free from foreign matter—bats, shale, and the like, sinkers and floaters; the coke must be graded to suit the customers' requirements. Of course, there should be a low percentage of ash in the coal and preferably an ash of the quality which gravitates to the bottom of the fire. The total production of coke in Halifax is equal to 13 cwt. per householder per annum, and part of the output is absorbed in industry, in schools, and in public buildings. The Corporation provides the transport. There is also a demand in private buildings. We supply the coke either loose or in bags containing 84 lb. or 14 lb.; the latter small bags are sold over the counters of 250 retail shops in Halifax.

We are told by the Author that the cost of selling gas has increased. That is partly due to the extension of supplies to rural areas, and in part to the improved service afforded the consumer. Whatever service we can render to the consumer is worth the money and is economical.

I come now to naphthalene, gum, purification, and moisture. The methods of dealing with naphthalene in its various forms are well understood. The choice of coal, the system of carbonizing, and the temperatures at which the different varieties of coal are carbonized will determine the form in which the naphthalene will appear. The distribution system in Halifax is naphthalene-free, and has been so for many years. Of course, the gas supplied is not free from naphthalene, but the natural "carriers" prevent the deposition of naphthalene in the solid form in the mains. We have no plant for washing gas in order to extract naphthalene. Apparently, trouble with gum is experienced when naphthalene is removed or reduced by artificial means. There are no gum troubles in Halifax.

Moisture is rather a different problem and one on which I should like to hear Mr. Stewart's views. In my experience, moisture is a condition set up in the dry purifying system; it has nothing to do with condensing or washing or scrubbing.

Purifiers in the northern parts of the British Isles should be properly housed. In four gas works in different parts of the country within my experience a syphon pump was never used; over a period of nearly 20 years I never pumped a syphon. In many gas works the purifying area is insufficient and in some cases the washing and scrubbing plant is totally inadequate. There has been no addition to the purifying plant in Halifax during the last 40 years, but the area provided is more than that specified by the late Mr. Thomas Newbigging (0·6 sq.ft. per 1,000 cu.ft. of gas manufactured per diem) and is less than the late Mr. G. H. Hislop's figure of 1 sq.ft. of purifying area per 1,000 cu.ft. of gas manufactured per diem.

"Pocket" Scrubbers.

Scrubbers nowadays are of the pocket edition type, and the manufacturers of those appliances, who are gas engineers of long experience, are obliged to satisfy the demand for such scrubbers, which could be put into a corner of the gas works. The space occupied by scrubbers of ample proportions, however, is small relative to the amount of work which such scrubbers will do, that work being necessary in preparing the gas for subsequent treatment in the dry purifier. A scrubber of the old-fashioned tower variety occupies only one-sixth of the space required for a dry purifier of sufficient capacity to take its place in the stream; but both are necessary—liquid purification to prepare the gas and dry purification to complete the process. Where purification by dry lime has been abandoned, liquid purification in its highest form is essential. Taking into account the cost of steam and the maintenance of pumps, washing and scrubbing cost less than dry purification, after crediting the dry purification account with the relief work done in the liquid purification system.

The practice in Halifax to-day is, and for eight years has been, to remove and dispose of spent oxide of iron and to re-charge the dry purifiers which are due for discharge. That is completed within a period of six or seven weeks between Easter and Whitsuntide, and then the vessels are shut down for the year. Over a period of eight years the sulphur extracted from the gas in the condensing, washing, and scrubbing plant has averaged 275 grains per 100 cu.ft. of gas manufactured, and the sulphur extracted by the oxide of iron purifiers has averaged 360 grains per 100 cu.ft. of gas manufactured.

The time of contact in the scrubbers at Halifax is generous. The spaces between the scrubbing elements provide accommodation for 20,000 cu.ft. of gas or one-eighth of the maximum hourly production. The gas is, therefore, exposed to treatment for 7½ minutes. The best result we have obtained so far is 7·84 grains of sulphur per 100 cu.ft. of gas manufactured; that occurred in November last. The figures are higher in winter, but there is work in progress on the scrubbing plant which, it is calculated, will improve the extraction in winter.

With regard to combustion characteristics, calorific value alone is an indeterminate measure of the value of a gas. If the composition and the specific gravity remain constant the calorific value will not vary, and for every purpose—but especially for process work—neither the composition nor the specific gravity should vary. The range of choice of calorific values suggested by the Author is generous. For "linking-up"—and that is a pressing need—we may be obliged to standardize in districts. Taking into account the fluctuations in the demand for products other than gas and the variations in the prices obtainable from time to time for these products, it may be necessary to limit the range to, perhaps, 450 to 500 B.Th.U. The Author's suggestion to "link up districts by means of small mains to deliver gas at a pressure of 50 lb. per sq.in." is a most admirable compromise in the circumstances outlined by him.

Gas Manufacturing Flexibility.

Mr. R. J. Restall (Stalybridge): The Author's remarks in his printed summary prompted me to offer some observations on a single carbonizing installation, which from a practical point of view illustrates gas manufacturing flexibility as applied to a works with an output of 162 million cu.ft. On such a works it will be realized at once that we are unable perfectly to satisfy ourselves by such developments as the Author outlines in his Paper as to the characteristics and composition of the gas produced. We have, however, a very large industrial load amounting on the total output to nearly 30 per cent. Many of the gas users have very exacting work to undertake and are to be relied upon to draw attention to serious variations in the gas supply. Observations are continually made of the appearance of the coke, which is dry cooled, and tests indicate that the volatile content is materially constant. Although we are not able to carry out exhaustive tests, particularly in regard to complete gas analyses, it has been found that the O_2 is generally round about 0·3 per cent., CO 15 per cent., and CO_2 3·8 per cent.

The Author draws attention to the flexibility of gas manufacture by suitable combinations of manufacturing plant. Such arrangements as are set out admittedly do give wide variations, but for those works on which is placed a single type of carbonizing plant the greatest care in plant operation is demanded to attain constancy.

Under the method which we work at Stalybridge having intermittent vertical chambers, dry coke cooling, and a benzole extraction plant, these coupled with the inclusion of a small coal-blending plant do give us reasonably constant gas, because, whatever carbonizing period we are working, the water gas produced is proportional, and the coke of particularly unvarying construction and constitution. With the aid of the benzole plant the calorific value is maintained within reasonable limits of 500 B.Th.U. The carbonizing plant is made up of nine 3-ton chambers, which are always maintained under fire. This may possi-

bly be considered expensive when the plant is working at 40 per cent. maximum, but whether the plant is working at 40 per cent. load or 80 per cent. load the overall efficiency remains practically the same after having reached a settled condition.

The sudden inflow of a quantity of either oil or water gas to meet peak loads would adversely affect the composition of the gas more seriously than the method we adopt with a single type of plant. On Dec. 23, 1935, we carbonized a matter of 42 tons and the same amount on Dec. 24 and 25, making approximately 740,000 cu.ft. of gas each day by fifteen charges during the 24 hours. On Dec. 26 and 27 we carbonized approximately 25 tons of coal making 400,000 cu.ft. of gas with nine and ten charges respectively. On Dec. 28, needing more gas, 39 tons of coal were carbonized, making 620,000 cu.ft. of gas with fourteen charges. For the whole of the month of December the thermal yield per ton never went lower than 73·5, and reached on two occasions over 90 therms per ton. I feel that complete gasification is the way of evolution, while coke is a very cheap form of fuel with a good demand; and whereas Mr. Stewart is able to regulate somewhat to meet coke market conditions, without the use of coal gas for firing the chambers or auxiliary waste-heat boilers, no such possibility exists with our plant.

The changing influences in gas manufacture are, as we all realize, of this age. For instance, a really cheap gas would increase the demand enormously, and a policy by the Government to limit the burning of raw coal would in the first instance devolve on the Gas Industry, but would also create in this country an unparalleled revival for the coal industry and effect a most important change nationally.

The present coal monopoly which virtually lays down the class and quality of coal handed out to individual undertakings if allowed to continue will surely affect the type of plant to be built in the future, and to a greater or less extent the calorific value of the gas manufactured, and I am sure that although to many the fewer the calorific values the better, this benefit would not compensate us for the trouble we are now experiencing from the coal industry.

The Right Attitude.

Mr. N. Hudson (Mirfield): It was with the firm opinion that de-naphthalenation and reduction of sulphur compounds to as many consumers as possible was the right attitude that my Company, two years ago, decided to install an oil-washing type benzole plant, not primarily to make money out of benzole extraction, but rather to make benzole extraction profits, if any (some hold there are none), pay for sulphur compound removal and de-naphthalenation. Our hopes have been exceeded, and to-day the oil-washing process at Mirfield, designed and re-designed by the makers—they have spent an enormous amount of time on it—is producing over 2 gallons of benzole per ton, which on distillation is dried at 106° C., gas being supplied to the town with just over 1 grain of naphthalene and between 7 and 8 grains of sulphur per 100 cu.ft. Prior to that, our test for naphthalene showed from 5 to 6 grains and our test for sulphur from 20 to 22 grains. The operation and supervision costs are very little more in a 100 million works—I think that a necessary qualification—than those for operating a straight benzole recovery plant. After a winter's operation with these results we are just beginning to appreciate the advantages, such as a reduction in maintenance costs on appliances, particularly storage water heaters, less trouble in services during cold spells, and an added confidence in recommending heating with flueless heaters. We are amply satisfied with the results, but we still think we can improve on the figures. Having got down to between 7 and 8 grains of sulphur per 100 cu.ft., we are sensible enough to realize that it will be more difficult to remove the next grain than to reduce the grains from 22 to 21.

In fairness to the makers, I should add that these results have been obtained by using a converted brush washer for washing purposes, which from tests made seems to be below capacity when our throughput of gas has been at its peak. This disadvantage has to a certain extent been rectified by adding to the wash oil at such times a quantity of further washing medium having a lower molecular weight, and returning to the washer certain distillate refluxes to achieve a similar object.

At the moment the plant is being operated on the exhaust steam from the engines driving the oil-circulating pump and from the scrubber engine; but at our maximum load, due to the lower temperature of the return oil and the increase in the amount of gas being washed, the amount of live steam required is equal to the amount of exhaust steam available from the power units I have mentioned. I understand that this steam figure is likely to be reduced greatly by distillation in vacuum, but I am afraid that such a proposition would not show advantages for the smaller sizes of gas producers. For the larger works I think it would materially reduce the costs of distillation.

The Aeration Test Burner.

Mr. L. T. Minchin (Gas Light and Coke): I feel that some criticisms of the aeration test burner are based on rather too sanguine a hope as to what it will do. One must not be misled into thinking that one could describe all the characteristics of gas composition by a single number any more than one could describe the quality of a man by a single number. All we can claim for the aeration test burner is that it shall represent the cone-forming characteristics of the gas under consideration in the bunsen flame, and it is only reliable in so far as one is considering the phenomena connected with the formation of the inner cone. Such phenomena, after all, are definitely linked up—when they are the result of gas composition—with the cone being too short; but bad combustion is always linked up with the cone being too long.

The effects of the variations in gas quality recorded by the aeration test burner are particularly noticeable in so far as they concern the lighting back of burners when they are first ignited. A gas fire, for example, which has been set correctly by the fitter at one time may commence to pop violently when operated by the consumer a few minutes later.

The statement that a specific gravity control of ± 0·025 is necessary for modern appliances is rather hard on the modern appliances. It implies a variation of −2½ per cent. in the gas rate, and surely that is not sufficient to cause any serious deficiency. I think you need to get about 10 per cent. before the slightest trouble begins to show itself. Of course, you cannot get nearer than 10 per cent. unless you take a very fine control indeed.

Perhaps Figure 1 needs a certain amount of explanation; it looks terribly complicated at first sight, and the right-hand part of the diagram is largely in the nature of a correction of the probable operation of the gas quality on the cone height. The principal factors affecting the cone height are calorific value and the flame velocity curve, and it is only necessary to bring in the velocity of the mixture as a form of correction. Therefore, the study of the diagram is simplified in the first place by considering only the left half.

I feel strongly that the standardization of gas quality is very important, and I do not think that any loss of convenience would be incurred if all the variable products of gas now being made in England were divided into three or four numbers instead of being spread over a very large number of different grades, of which we have very little real idea as to what each represents.

Unnecessary to Extract All Benzole.

Mr. C. Cooper (W. C. Holmes & Co., Ltd.): It seems to have been assumed fairly generally that in order to ensure a low sulphur content in gas by the oil-washing process we must extract the whole of the benzole; but that is not necessarily the case. I think we can say that as a general rule we can reduce the sulphur to below 10 grains, down to 5, with a variable extraction of benzole of from 1 to 3 gallons per ton. It would be possible to reduce the sulphur from 5 to 3 grains by extracting the whole of the benzole and exercising great care with regard to the CS_2. The problem of reducing the sulphur to below 3 grains is one upon which we have not very much data at present, and I am afraid the realization of Dr. Smith's ideal of reduction to 1 grain, mentioned this morning, is a matter for the distant future by means of any process either of oil washing or carbon extraction known at present.

With regard to the possible changes in the character of gas where an undertaking may have three or four different sources of manufactured gas, I recently came across the extreme case of an undertaking receiving coke oven gas of probably 0·38 gravity, the only standby plant for emergency giving carburetted water gas at 0·58. I do not suppose Mr. Stewart will be prepared to put forward a solution of that difficulty, but I think it is a difficulty which an increasing number of undertakers will have to face, though not perhaps in the same extreme degree. Another extreme case I have in mind is that of an undertaking where they do not suffer so much from peak loads as from depressions of load, and they have considered very seriously the problem of using gas for the stand-by firing, economizing on the coke; with coke at something like one-third the therm cost of gas it is not so very much out of the question.

Mr. Stewart agreed to reply to the discussion in writing.

Distribution of Gas in SUBURBAN AND RURAL AREAS

Communication No. 156

by
H. J. ESCREET
(Distributing Engineer, Gas Light and Coke Company)

Mr. L. F. McLeod (South Metropolitan Gas Company): I am sure there are many in this room who are a little envious of Mr. Escreet and his colleagues, because many gas undertakers, unlike the Gas Light and Coke Company, have to deal with circumscribed areas in which the only possibility of additional development depends on that doubtful proposition known popularly as slum clearance. Fortunately for the Gas Light and Coke Company, the problem of slum clearance does not affect its area so materially as it affects the areas of some other Metropolitan companies; and some very definite and valuable information has been obtained and collated by Mr. Escreet.

Coming to the technical aspects of the Paper, I notice in the first place that greater use is being made of the half turned and bored joints—*i.e.*, the turned and bored joints having the front part filled with lead. That practice is common in some places, but my experience is that the fully turned and bored joint is very satisfactory, and I am wondering what difficulty Mr. Escreet experienced with the fully turned and bored joint to lead him to refer to its unsuitability for medium pressures. I would instance a large main, of 36-in. diameter, laid 8 or 9 years ago through one of the most densely populated parts of our district, the joints being of the fully turned and bored type. The main was tested to an air pressure of 5 lb. by means of a mercury column, and it retained that pressure very satisfactorily throughout a period of days; subsequently, although in full use day by day and working under a pressure of something like 1 lb. per sq.in., it has not developed a single leak at any one of those joints. Perhaps it is due to the use of the half turned and bored joint that the prices quoted in the Paper for main laying are somewhat higher than those within our experience; the percentage difference may be accounted for by the extra labour involved in the making of the half turned and bored joint.

High pressure distribution in the Grays area certainly has some advantages. But there is another aspect of the case. Quite recently considerable attention has been given to the maintenance of gas supplies, by reason of the possibility of damage to systems by enemy aircraft, and I am wondering what would be the position if an area such as Grays were subjected to an aerial bombardment such as we anticipate in the next war. The fact that high pressure mains run along streets and individual consumers are supplied through governors seems to me to be somewhat disadvantageous; but perhaps Mr. Escreet will be able to clear up any doubts I have on that matter.

Mr. J. A. Gould, M.C. (South Suburban): When dealing with the annual costs of supplying new consumers, the Author has stated that normally the cost of carcassing the houses is borne by the consumer. I assume from the facts mentioned in the Paper that the cost of the service pipe is charged to the consumer in addition. If this is not the case and this cost is not met by the consumer, then it would appear that the cost of the main is not the only factor which should determine if a supply should be given. Let us consider the case of an estate where the average prime cost of the mains per house is, say, £5, of the service £2 10s., and of the house piping £1 15s.—all I think typical instances of average costs. The cost of the service if not paid by the consumer would upset seriously the economics of the supply if such service cost were not taken into account.

Mr. Escreet's remarks upon the annual charge, or the profit per therm applicable to the interest on mains capital, are very interesting. My experience in the application of a formula is that it is very difficult to calculate the proportion of the costs of the required trunk mains chargeable to the estate developers. So far as the mains actually needed to supply the requirements of the estate are concerned, these mains may be incapable of carrying any additional load should further building development take place. It would be interesting to know if Mr. Escreet applies a definite proportion of the annual charge of 2·5d. mentioned in his Paper to such trunk mains. In my opinion special consideration should be given to this aspect of the case, and the deficit or credit on the actual mains required to meet the demands of the estate should be calculated separately, the cost of the supply main being dealt with on its merits. The South Suburban Gas Company at present calculate the economics of the estate mains upon the formula $20C=N$, where C is the capital cost of the mains and N the estimated total number of therms consumed per annum. Where only one main is laid in each road, the cost of the additional length of service pipe required to cross beneath the road is added to the capital cost of the mains. The capital cost of any trunk mains is considered separately, the portion of such cost chargeable to the estate developers being calculated in accordance with individual requirements.

The representative figures of the annual consumptions of new property given in the Paper agree with those found in our district. Mr. Escreet does not mention if the Gas Light and Coke Company ever make a charge for mains where the economics show a deficit. We have made such charges in many cases.

It would be interesting if Mr. Escreet would state how his Company deal with the land-owner or developer who wishes to sell land with roads and a gas supply and other services. In my opinion such developer or land owner should enter into an agreement with the Gas Company whereby he bears the capital cost of the mains, this capital cost being returnable as the houses are built or connected to the gas distributing system. Alternatively refunds of the capital cost could be made, calculated upon the gross gas rental derived from services connected to the mains. In the South Suburban Gas Company we have negotiated with a number of developers upon this question, and have induced them to enter into such agreements.

The Author's table and details of mains costs per yard of main laid are very instructive, and I should be interested to know whether these refer to the work of the Gas Light and Coke Company's own men or of the men of contractors.

Turned and Bored Joints.

I am interested to hear of Mr. Escreet's opinion upon the half turned and bored joint, and to know that he has found it unsuitable for use on mains carrying medium pressures. I have great faith in fully turned and bored joints, and have never understood the necessity for the half machined joint, which was originally introduced to provide a safeguard against badly machined castings. If the half machined joint is not up to its job then it would be better to dispense with it and employ the fully machined joint or the ordinary lead joint, and, in the case of the latter joint, save the cost of machining. I have laid in South London and in Kent many miles of mains, from 36 in. diameter downwards, having fully turned and bored joints, and I cannot speak too highly of them. My experience with such joints was obtained under Dr. Charles Carpenter, who has consistently advocated their use for mains working up to medium pressures. I have found that if the joints are accurately machined and the pipes are laid properly no trouble is likely to be experienced.

I quite agree with the Author's statement that the ordinary lead joint will not withstand medium or high pressures without frequent attention, but my experience with the composite joints described by Mr. Escreet has not given me much faith in them when such joints are employed on mains working under medium and high pressures up to 10 lb. per square inch. I regard these joints in much the same way as I do the half turned and bored joint—namely, that one cannot rely upon two jointing mediums in the same joint. In the composite joint I think the tightness of it must rely either upon the lead or the rubber, and if it is the rubber then I am of the opinion that this medium should be employed in a joint such as the Johnson coupling. We have experienced considerable trouble from lead jointed mains leaking under medium pressures. I have made a number of experiments to ascertain the best means of correcting them, including cutting out the lead and remaking the joint with a rubber ring and lead wool. Eventually I tried the Dresser leak clamp, which joint employs a rubber ring held against the face of the socket by special spigot and socket straps. A leak clamp of this kind could until two years ago be obtained only from America, but we have been successful in interesting an English firm of flexible joint manufacturers in

this type of clamp, with the result that we can now obtain our supplies of English manufacture. I am using these joints to stop leakage from our pumping mains, and have every reason to hope that the pipe joints so treated will not require further attention for many years to come.

Extremely Valuable Figures.

Mr. F. C. BRIGGS (Dudley): I am very appreciative of the excellent work which has been done by our retiring Secretary, Mr. Alexander, in the face of very many difficulties, and I am sure he will agree that he has not come to the end of his very good work. But I want to suggest to the incoming Secretary that it would be a very great advantage to have the printed Papers distributed to members of the Institution at a very much earlier date than is the practice now. I know that in this matter we are very largely in the hands of the Authors, and that is the reason why I take the opportunity of mentioning it publicly, for I hope the suggestion will be broadcast. If we had the Papers earlier we could give adequate attention to them before the meetings. The matter is of more importance to Managers, who are interested in all the Papers presented, than to departmental specialists. I regret that I have not been able to make a proper study of Mr. Escreet's Paper, because I replied with alacrity to the invitation to take part in the discussion, for Mr. Escreet is a very old colleague of mine. We were pupils together, and I should like to congratulate him upon the fact that he has filled his important post with conspicuous success. If it is not the sinecure to-day that perhaps it was previously thought to be, a good deal more interest attaches to it by reason of the extensive high pressure distribution system that the Gas Light and Coke Company has.

We are indebted to Mr. Lacey and to Mr. Escreet—I do not know whether, from Mr. Escreet's opening remarks, the Paper on "The Economic Aspects of High Pressure Distribution," presented in 1928, was his or Mr. Lacey's—for the very valuable figures published from time to time with regard to mainlaying and pumping costs. Those figures are not to be criticized because, as Mr. Escreet has pointed out, local conditions vary enormously; but I have found the figures extremely valuable in my own work.

The Paper by Mr. Escreet brings out most strongly the very important and serious factor of the heavy and increasing capital expenditure involved in the distribution of gas. The Gas Light and Coke Company is more fortunate than many undertakers in being able to secure consumptions of 100 therms per annum in artisan dwellings. In the case of my own undertaking, which serves a colliery district, and in many other undertakings, the figure is nearer 54 therms per annum. That lower figure is not due to lack of intensive selling or to lack of promotional tariffs. Mr. Escreet's figure of 8 per cent. upon mains costs to be met is not unreasonable, and it means an annual charge to him of 2¼d. per therm in suburban areas. I compute that that is equal to a capital expenditure of some £534 per million cu.ft. of 450 B.Th.U. gas sold—a figure as high as the total pre-war capital expenditure of very many undertakings. In conditions of modern competition this cannot be a revenue charge, and it is gradually and inevitably nullifying all the economies effected in manufacture and in other directions.

The Paper is concerned only with mains. But the General Manager has to deal with the matter further. Service pipes, meters, and cookers on prepayment meter installations, which most houses on Council housing estates entail, and the greater part of provincial development is on those lines, come into the picture. After the payment which can be obtained has been secured, the total capital expenditure by an undertaking to-day upon suburban development, and more particularly upon local authority schemes, amounts to some £1,500 per million cu.ft. of gas sold, against probably from £250 to £400 before the war. If that were met by the consumers of gas on those schemes, the price of gas would need to be about 3d. per therm, or 13d. per 1,000 cu.ft., more than it is, in the case of my own undertaking. Truly, the gas consumer generally is subsidizing the ratepayer still. But it is also interesting to note the point brought out in Section VI of the Paper, that considerable economy can result from the adoption of low-pressure pumping as compared with entirely low-pressure distribution, and it behoves us not to be shy of pumping. It is also interesting to note the point that is inferred rather than elaborated in Section VI, that very considerable economy and improvement can be effected by quite small local storage to deal with peak loads. These loads, per minute, may be considerable, but in total volume they are not large; they last for a surprisingly short time. In Section VII the Author mentions steel tubing for service pipes, protected either by wrapping or by cement or pitch in troughing. Does he mean steel as distinct from wrought iron? Even if the pipe is protected, does he not think that wrought iron is preferable? The pipe may be protected when it is left, but it is impossible to ensure that no other road authority will disturb the wrapping in the course of some future work of their own; wrought iron seems to offer an added insurance. Why does not Mr. Escreet adopt wrapped pipes universally in the place of pipes protected by pitch in troughing? Although the joints on wrapped pipes have to be wrapped by hand, the risk of human error seems to be very much less.

A Contribution from Builders.

Mr. P. RICHBELL (Croydon): I gather from the Author's opening remarks under the heading "Annual Costs of Supplying New Consumers" that his Company make themselves responsible for the whole cost of laying the necessary mains. In my Company we still receive a contribution from builders towards the cost of laying mains, and in the case of estates which are being developed where the frontage to the various roads is being sold in individual plots, an agreement is entered into for a period of seven to fifteen years according to the probable rate of development of the estate with the developers, under which they agree to pay an annual charge based on the interest on the capital expenditure involved in laying mains, less an allowance equivalent to one-eighth of the gas consumed in any one year on the line of main. These contributions amount to approximately 33 per cent. of the expenditure on mains laid in connection with the development of new estates.

The Author states that the annual charge of 8 per cent. must be met by the profit from the gas consumed per annum in the houses to be supplied. I am afraid I do not quite understand his definition of the word "profit" in this connection and wonder whether he would give a further explanation of this matter. I presume that the standard figure of 2·5d. per therm referred to later in this section of the Paper is purely an arbitrary figure for the guidance of his staff.

With regard to mains costs, I always feel very diffident about comparing one Company's cost with another as the basis of computation of these costs is always different. It is my Company's practice in determining the costs of main laying to base the figures on net cost of labour, materials, and cartage. No overhead expenses are taken into consideration in this connection. I thought it might interest the members to know that on the above basis the average costs per yard of laying large mains in my Company's area are as follows:

12-in. main	£1 2s. 9d.
18-in. main	£1 18s. 3d.
24-in. main	£2 14s. 11d.

With regard to cost of supply to newly developed areas, we have recently completed an L.C.C. estate consisting of approximately 4,200 houses and the cost of the local mains was £15,440 8s. 10d., and feeder mains £3,866 7s. 6d., making a total of £19,306 16s. 4d. The average cost per house for mains was £4 11s. 4d. When the mains were laid on this estate it was decided to lay a main in each footpath to avoid disturbance of the carriageways in the future and effect economy in the laying of the service pipes. The above costs include the laying of the whole of these mains. I quite agree with the Author that it is not possible to lay feeder mains to a strictly economic law because when determining the size of feeder mains required to supply a certain district the size of main is based on the ultimate development of the district which may take a number of years to complete. On the other hand, it is certainly not an economic proposition to lay a main large enough to meet present requirements and a few years later either have to enlarge the main or work the main at pressures beyond the economic limit.

I am a little puzzled in connection with the Grays system whether the high-pressure mains are used to feed ordinary district mains through governors or whether services are connected direct to the high-pressure mains. If the latter method is adopted, will the Author please inform me the maximum pressure to which gas is compressed in the "Hortonsphere" and also the outlet pressure which is maintained?

With regard to spun iron pipes, we have used both the type cast in sand-lined moulds and also in metal moulds and I feel that both these types of pipes have proved quite satisfactory. With regard to steel mains, we have just commenced laying three and a half miles of 24 in. and 20 in. main with the spherical type of joint and coated with bitumen asbestos compound. This joint is on the cup and ball principle and enables one to lay mains in slightly curved roads without unduly cramping the joints. We are also electrically welding a section of this main. I must say that this method of welding appears to be much more

satisfactory than the oxy-acetylene method generally adopted for this purpose.

I strongly endorse the Author's remarks contained in the conclusion of his Paper in regard to plant and materials used in the distribution of gas. I am afraid the Distribution Department is very often looked upon as the "Cinderella" of the undertaking, and I should welcome some association whereby those in charge of distribution systems could have some opportunity of exchanging their experiences in connection with the various types of plant and materials.

Conforming to Modern Requirements.

Mr. B. R. PARKINSON (W. Parkinson & Co.): It is something of a romance that the well-known 48-in. trunk mains from Beckton, forming one of the oldest and largest systems of feeder mains, should now serve to conform to the most modern requirements of high-pressure distribution. Having prepared the first scheme for high-pressure supply to part of the Essex area before it was taken over by the Grays and Tilbury Company, I have been always interested in the scheme for comparatively high-pressure distribution installed by that Company; and it is interesting to know, from Mr. Escreet's Paper, how that scheme compared with the economic formulæ.

With regard to steel mains, about half a generation ago I conducted a raging and tearing propaganda in an effort to dislodge the Gas Industry from its complacency over cast-iron pipes. One mellows as the years go by; but it is certainly to me a matter of great encouragement, as I am sure it will be to many, to note statements made in two recent Papers with regard to steel mains. One of those Papers was presented to the Institute of Fuel last year by Mr. H. A. Humphrey (Engineer and Director of the South Staffordshire Mond Gas Company) and was entitled "The History and Development of Mond Gas for Industrial Purposes." In it he stated, with regard to the Parliamentary proceedings on the Company's Bill at the beginning of the century: "The Author felt justified in stating before Parliamentary Committees that the steel mains ought to last 20 years; and now, after 35 years, no limit of life can be fixed, even under the adverse conditions of the Black Country. Except for some sections where electric currents were allowed to leak into the ground in a manner which would not to-day be tolerated by any electric supply or tramway company, the bulk of the mains are equal to new; that is, they have lost no weight from the inside or the outside."

The other extract which I should like to bring to your notice is from the Presidential Address delivered last week by Mr. C. R. Fowler before the Eastern Counties Gas Engineers' and Managers' Association. He said: "While the works were being built, new mains were laid through the district. In 1911 it was unusual for steel mains to be specified and, although not quite the first, we were the second small Company to lay all steel mains throughout the district. The decision has been amply justified, and after 25 years' use they are found to be in a condition equal to new whenever exposed for service tapping."

Consumption per Consumer.

Mr. G. M. GILL (London): Mr. Escreet's work is based upon London and suburban conditions, where the consumption per consumer is a good deal higher than it is in the country areas. In quite a number of the undertakings with which I am concerned the consumptions per consumer range from, say, 35 to 60 therms per annum. Of course, where the consumptions are so small, the whole conditions of cost are affected adversely. There may be quite a nice housing estate under construction; you work out the costs, on the basis of consumption figures gained from previous experience, and you find that you really cannot afford to lay the main to the estate. Yet we have to take a broad view, and do it. But I should like to make that point, because many of us would like to have a consumption figure of 100 therms per consumer per annum; in those circumstances we should feel that we were on thoroughly sound lines. One of the difficulties is the fact that electricity and gas are being supplied to the same houses, the occupiers of those houses using both commodities. In fact, the class of business is such that it is no good to either the gas or the electricity people, because the amount of business is small. Again, the consumer has to pay the top price for both commodities; he comes at the top of the block, so to speak, in respect of both.

I should like to ask whether Mr. Escreet has had experience of expanding nipples with spun pipes. We can get very good joints with spun pipes now for high pressures, and it would be of great advantage to have also a good and reliable joint for the service connections, so that those connections would stand the same pressure as the pipe joints. I am carrying out some experiments, and Mr. Escreet, by reason of his great experience, would be very helpful if he would give some idea of what can be done.

Col. F. C. TEMPLE (President of the Institution of Sanitary Engineers): I should like to make the suggestion that you should consider the possibility of putting on the market some cheap, small, gas-driven motors. The electrical people have not given us anything cheap enough yet. I am perpetually looking for cheap power for lifting water or sewage and for purifying sewage. It seems that you have beaten the electrical people in respect of a great many things, and I wonder whether you may not be able to beat them in the matter of pumping plant. It is still quite certain that for pumping plant, coal-fired boilers, or Diesel engines working on crude oil are cheaper propositions than the electrical people can give us. But people tend towards electrical plant because it is convenient and clean and it does not call for the employment of so many men. Of course, the electrical people may let one down thoroughly by shutting off the power without giving any warning. By doing that more than once on the same line—perhaps it was not their fault—they succeeded in splitting the casing of a 12-in. centrifugal pump which I had installed; it was split right round into two pieces. That is a matter which has to be watched. You would not be likely to do that, because normally you store your product; having a reserve, you do not need suddenly to cut off supplies.

Bases of Estimating Costs.

Mr. F. H. ROBINSON (Bishop's Stortford, Epping, and District): The bases of estimating costs of long-distance supplies must necessarily vary in each area. In 1927-28 I carried out an extensive scheme of development for the Harrogate Gas Company covering an area of 193 square miles with a distance of 27 miles between the extreme points of supply, and for this scheme I adopted a similar basis to that given in Mr. Escreet's Paper. Interest at the rate of 6 per cent. on the cost of the main, governors, &c., was allowed for, plus the cost of pumping (1·59d. per 1,000 cu.ft. of 460 B.Th.U. gas), interest on the capital cost of the extra manufacturing plant required at the gas works, and, in addition, the difference in the capital cost per million between the Harrogate Undertaking and the purchased undertakings was added. These items made up the differential charge for the outer areas.

About 35 miles of medium pressure main were laid to supply the seven gas areas taken over and the total cost of the scheme, including purchase of the undertakings, amounted to £117,257 at the end of five years, while the return on this expenditure was 7·8 per cent. against 6 per cent. originally provided for. At the end of one branch of the distribution system 11 miles from the gas works two cylindrical pressure holders were installed, each 30 ft. long by 9 ft. diameter, with gas engine driven compressors working to 40-45 lb. per sq.in. pressure. These were installed in 1930. On the route of this main, several villages were dependent entirely on a medium pressure being maintained, and, as additional storage was required, it was felt that high-pressure storage was the best. Governors and connections were so arranged that high-pressure gas could be fed back into the trunk pressure main so that in the event of any repairs to valves being required or new branches inserted, the supply to the village was maintained. At the same time, the pressure was maintained during the peak load and the capacity of the main thereby increased. It was also possible to feed from these containers through a governor direct into the town or into the ordinary holder.

For the purpose of calculating the sizes of the pressure mains feeding direct into a district I found 15 cu.ft. per hour per consumer was adequate for that area which is essentially rural in character. The final pressure allowed for at the extreme ends was 1 lb. per sq.in. at the holders of the outside stations. To give this, it was only necessary to have an initial pressure of 6 lb. in the summer and 9 lb. in the winter, and under these conditions a straight line on the pressure chart on intermediate governed services was easily maintained. The distribution system being designed for these medium pressures allowed for future developments as the capacity of the mains could be greatly increased by raising the initial pressure at the gas works, while the compressors were designed for much higher pressures.

If I may venture one criticism of Mr. Escreet's Paper it is that the Grays and Tilbury Scheme appears to have been designed with a high-pressure of 35 lb. or so and very small mains which allow no margin for future developments. This is an extensive area and its population is

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increasing fairly rapidly. It would be interesting to know, however, how the additional consumption is to be met from a distribution system which is apparently already fully loaded.

In the Bishop's Stortford and Epping Area, covering nearly 300 square miles, for which I am now responsible, the supply is mainly on the low-pressure system with district holders. This arrangement gives even pressure generally and the holders certainly increase the carrying capacity of the mains and so postpone the date when enlargement is necessary. At times, however, when severe weather comes along and consumers *en route* are using probably twice as much gas as they normally do, there is difficulty in keeping the holders well filled. Extra pressure at the works is limited to that thrown by the heaviest holder unless a booster is available. If this is used, then the consumers near the works are subjected to an excessive pressure for the benefit of those further afield and thus the straight line desirable on the pressure chart is far from being realized. This system of low-pressure and district holders is very useful up to a point, but it has not the flexibility and reserve of a medium pressure system for large rural areas. About eight miles of medium pressure main have been laid in the Epping District and will be extended as occasion requires. Governors are all enclosed in steel kiosks erected by the roadside. Underground chambers are objectionable in many ways, and in the event of escapes, are a source of danger.

The Author's Reply.

Mr. ESCREET: I should like to make a detailed reply to the discussion later in writing. But I should like to deal briefly with Mr. Briggs' suggestion that I had inferred that Mr. Lacey's Paper was really mine, though it was published under Mr. Lacey's name. That is entirely wrong. For one thing, I learned everything I know about distribution from Mr. Lacey. I meant to convey in my opening remarks that the detailed figures in the appendices in Mr. Lacey's Paper, which figures covered a wide range, had to fit a smooth curve; but a smooth curve does not really pan out in practice, and that really accounts for the discrepancies. I do not claim credit for the basic work of that Paper.

With regard to the criterion for supplying housing schemes, the 2·5d. per therm to which we work is rather a limiting case. A great deal of the estates, in fact, come out at a much lower figure. We are fortunate in that most of the estates in the suburban area are what might be called "mass-produced"—*i.e.*, a man slams up 500 houses in six months or a year. We have to get on with the laying of the mains, for obviously we cannot turn down such a scheme. But the criterion is used on the outer areas, where just a few houses are going up and where it is doubtful whether it will pay. Even then it is interpreted rather liberally. The pence per therm basis is used to give us an idea of the risk that we are taking, rather than as a basis on which to make the final decision.

TECHNICAL ASPECTS OF

Communication No. 157

The Holding Company Movement

by
G. M. GILL
(Director, Severn Valley Gas Corporation, Ltd., and Gas Consolidation, Ltd.)

Col. W. M. CARR: The activities of holding companies have been very great, but there has not been an opportunity of discussing the problem of linking up and consolidating within our own Industry. Such an opportunity could be afforded only on occasions such as this when we are assembled at our Annual Meeting. Perhaps in the early stages of the holding company movement I was most critical, and even to-day I admit I am most critical and introspective concerning the best way of dealing with this problem. After all, the electrical industry has had behind it the Electricity Commissioners; it has had the weight of the Government behind it, and the authorities are doing their best to consolidate it. What is our answer to be? I do submit that this holding company movement has been clearly demonstrated as one means of consolidating our position, of trying to do for ourselves what the Government has been trying to do for electricity; but we shall do it, I hope, on better lines than those on which the Government has been able to deal with the electricity position. It is essential that we should be introspective and highly critical of ourselves in this matter. We must be certain that we are not placing a burden upon those whom we are trying to help which will outweigh the assistance we are able to render. For that reason I do welcome the manner in which Mr. Gill has set forth the detail of his organization. I agree with him on many points, but I disagree with him on many others, and it is natural, of course, that there should be differences of opinion in regard to this problem as to how help can best be given.

For example, in the first instance we must never lose sight of the fact that in an industry such as ours the most important man must be the man on the spot, who is responsible to the undertaking; and those of us who are connected with the conduct of holding companies must be extremely careful that we do not destroy the initiative of the man who is responsible on the spot. After all, he will make or mar the success of the undertaking, whatever the holding company may do. The holding company must remember that the machinery which it sets up must be machinery which will assist. After all, we are only going to use our size to bring to the benefit of the smallest undertaking the advantages of the largest. That is the only reason and justification for our existence as holding companies. In other words, unless by forming holding companies we can effect better service and supply cheaper gas, then what we are doing is of no avail. In our early stages we must be extremely careful that in setting up the machinery and in making any move we who are responsible for the control of holding companies must move in conjunction with, and with the goodwill of, our managers. It is essential that at every stage the Directorates of the holding companies should consult their chief officials on the spot, and those officials must of necessity be 100 per cent. in the confidence of the Directors of the holding companies.

Disclosing Plans.

It has often been said that we should disclose our plans. Well, I am sure that everyone in this room will see the difficulty of doing that. There are some people who are ready to speculate and make a bid. When plans have become fairly obvious by reason of a certain number of acquisitions, we have often seen a very great rise in the value of the shares of local companies; such rises would never have occurred had it not been that the plans had disclosed themselves by reason of the very nature of the development and the acquisitions that had already taken place. I do not think any of us who are interested in the working of holding companies are working without a definite plan; if we are doing so we are making a great mistake. Even where the physical linking of a group of companies is not possible, much can be done by the centralization of certain services and particularly by mutual assistance in sales development.

I notice that in Mr. Gill's organization there are twice as many people on the technical side as on the sales side of his staff. I feel that the balance is just 100 per cent. wrong and that our subsidiary undertakings in the main require far more assistance on the sales side than on the manufacturing and technical side. At any rate, that has been my experience during the last twelve months, and I feel sure that in due course it will be Mr. Gill's experience, because it is in the direction of sales that we can offer greatest help. For example, individual companies which may not be physically linked but which are operating within a radius of 15 or 20 miles can organize a sales campaign to serve all of them. That could be developed and followed up by properly planned selling in a manner which none of those companies could do individually. We can also help very much by co-operative advertising in newspapers circulating over a number of gas areas.

With regard to industrial sales, Mr. Gill says that he has one industrial salesman. In the Severn Valley Gas

Corporation, Ltd., and Gas Consolidation, Ltd., perhaps, there are not so many undertakings serving industrial areas as there are in the United Kingdom Gas Corporation, with which I am connected, but I would have thought that in each of one or two of the towns, such as Gloucester and Newport, there would be opportunity for whole-time occupation for one industrial salesman at least. In the United Kingdom Gas Corporation we have three industrial gas salesmen fully employed at the moment, but our companies can do with very much more assistance and are calling for much more assistance than three men can possibly give. It is also necessary for a holding company to have in its industrial sales department at least one trained heating and ventilating engineer. For the moment I am including in "industrial sales" such problems as central heating, as, for instance, in cinemas, churches, &c. That expert should be able to tackle such problems for the subsidiary companies, and enable them to put forward schemes to prospective users, as we have to do now, if we are to get those loads, on the basis of the annual cost of heating a particular building. That is the only way in which we can obtain that class of business.

Centralized Administration.

As Mr. Gill rightly points out, economies can be effected by the physical linking of undertakings and the closing of smaller works, and we have a number of such developments in progress at the present moment. That applies not only to the smaller works, however. In Yorkshire, where coke oven gas is available, we shall be linking up to the cheaper supply with some larger undertakings. But economies can also be effected in other cases by the co-ordination of sales and by linking up administration. The manager of a small works has to see that his meters are read, that bills are sent out, and that the money is collected. Billing can be grouped between four or five companies with advantage, always provided that the manager is not deprived of necessary information. A manager must have knowledge of the consumptions by his consumers if he is to keep a check on his business, and therefore in any centralization of administration we must be careful not to take away from a manager such information as he would have if he were doing the whole of the work himself. He must be encouraged to make use of that information in the usual way, and he must be encouraged to look not merely at places where he was gaining ground, but also, most important of all, in places where he was losing ground.

Business that is lost is a very much more important matter for the consideration of the manager than is the business he has gained, because he must plan the prevention of loss in the future. Business held is more important than new business gained. We should not mislead ourselves—as we are sometimes inclined to do—by estimating our position on the value of appliances sold. The only true estimation of our position is obtained from the quantity of gas sold per consumer, and if a holding company is going to assist to increase the quantity of gas sold per consumer, it will justify itself; that is the way in which it must justify itself.

Then there is the question of how a holding company should charge the subsidiaries for the services that it renders. The policy followed by the holding companies with which I am associated is to render a charge on the basis of the thousands of cu.ft. of gas sold, the charge being varied as between the gas sold to the domestic consumer and the gas sold to the industrial consumer. For the sake of assessing an industrial user, we have taken those who consume gas in excess of 500,000 cu.ft. per annum as forming a basis. Mr. Gill's companies make a percentage charge on the gross revenue, the percentage decreasing as the gross revenue advances, and I look upon that basis as probably having advantages over the basis upon which my company is working. I do not think it desirable, however, that a holding company should take commissions on purchases. I appreciate that all contracts which may be made with manufacturers, and upon which the subsidiary companies order, offer much greater reductions to the smallest undertakings than to the larger ones. But, after all, in the past there has been little difference between the prices at which a holding company can buy and those at which the largest undertaking can buy. I do not say that a holding company can do better in that respect than an undertaking selling 7,000 or 8,000 million cu.ft. of gas, because I do not think it can; but it can do better than the average company, and for that reason there is disadvantage in taking commission on sales.

If on the face of each subsidiary company's balance-sheet there is shown the amount taken by the holding company for the services it has rendered, the management of a subsidiary company can ask themselves whether they have had value for the amount they have paid the parent holding company for service. Similarly, the management of the holding company can consider whether they can justify the charges made for their service. For that reason the matter is of very great importance.

A Different Perspective.

Mr. P. C. Holmes Hunt (President, National Gas Association of Australia): I want to ask this gathering to take a different perspective of this problem of collective control than that which apparently is taken in the Gas Industry in England to-day. I ask you because in Australia we have very many large empty spaces; Australia is a country as big as the United States. When I tell you that the Colonial Gas Association (in which I have the honour to occupy a rather responsible position) covers a distance, between its extreme eastern and its western works, of some 2,500 miles, and that in the States in which we operate the various works are sometimes separated by hundreds of miles, you will appreciate that the linking up of those works with high-pressure connections is out of the question.

There are three fundamentals which give a justification for the collective control of gas works. They are control of finance, control of collective purchasing (principally coal), and the centralization of an engineering and technical staff which can direct and assist the various concerns. The picture is not complete unless I tell you that some of the works which we own are making only 10 million cu.ft. per annum, and some of them less than that; in many cases the manager is also the gas fitter, and he has one or two other men who do the stoking and odd jobs. Still, we manage to get along. We have some 26 works in the undertaking to-day, and although we are going to celebrate our jubilee next year, our output is very much behind that of the holding companies as I understand them to exist in the Old Country at the present time. We have developed our management on different lines from those followed here. I understand that you develop the finances of the particular undertakings to a large extent.

A statement in the Paper which I found to be excellent reading is that in respect of two small companies £15,000 of 4½ per cent. preference stock has been issued at par. I assume that that stock has been issued for the small companies, and that they have not the responsibility, for it has been underwritten by the larger company. We have never touched that system of finance, because in the course of years we have found it better to handle the finances centrally. The consequence is that the holding company or the collective management is entirely responsible for the finance, and under that system the various works receive loans, charged to them at loan rates, in the amounts required to enable them to carry out their extensions. We have a large number of small works which are directly owned and run (they are not owned by small companies); and in respect of the companies that we control we have not been content just to secure a majority holding, but we have 98 or 99 per cent. interest. Those who have stood out do not own very many shares—and they have declined to sell those shares for reasons of sheer devilry! So that our control is complete and nobody else has a say in the management.

Advantage of Local Boards.

It is impossible for us, situated as we are, to formulate local Boards of control such as you have here. We find that when we have taken over a company it is better to have a small local Board to maintain the interest and to assist the Head Office administration, for they are hundreds of miles away. On such Boards we certainly have our own direct nominees, who attend the Board meetings only when they are visiting the various undertakings. Those nominees are mainly our own Group Control Officers, who are established in the various States. Australia has many large States. We have an Engineer in charge in Queensland, an Engineer in charge in New South Wales, and we have a Works Inspector at one of the smaller works in Victoria. Those men are continually going round to the works, adjusting details and reporting to Head Office. Requests for money to expend in connection with the undertakings are very seldom turned down; any recommendations by a Manager are considered by the Supervising Engineer and are reported by him to Head Office.

Mr. Gill's Paper refers to the special staff necessary for dealing with a large number of controlled companies, including a Joint Secretary, a Comptroller of Purchases, and a Comptroller of Accounts. We have found that centralization is of great benefit from the point of view of a Publicity Officer; we have found it necessary and expedient and well worth while to circulate among our Managers and staff periodically a house organ, not of the back-scratching type, but one which conveys information

of what is going on and general information about the gas business at large. In conclusion I would say to you as the result of experience—and I have been in the Colonial Gas Association for more than 20 years—avoid over-elaboration, avoid too much concentration and, whatever you do, do not stifle the initiative of the local Manager.

Importance of Financial Aspect.

Mr. F. C. BRIGGS (Dudley): The Institution is indebted to Mr. Gill for a very concise and detailed description of the organization of holding companies. Think of them what we will, holding companies are now with us, a natural growth of the rationalization of business generally. The Industry should, I think, be grateful for the manner in which they have come, and in which at the moment they are operating; but the Industry is naturally much concerned as to where and how they are going in the future.

I think most of us would admire a good deal of the technical organization of the Companies with which Mr. Gill is connected set out in this Paper as going a long way towards a high ideal. If no detailed commendation is made upon this it is only to save time in the discussion, but I think it should be emphasized first in order that any criticism that may be made should not be taken as a general condemnation.

Mr. Gill says that as this is a technical Institution it is not proposed to follow too closely the financial aspects of the holding companies and their operations. But the two aspects cannot be divorced. The success, more, the value, of a holding company must depend ultimately upon the financial result. The essence of the matter must be "does it pay?"—*i.e.*, is it in the material interests of the three partners, consumers, shareholders, and employees of any individual gas undertaking to become a subsidiary of a holding company; and if, as may be admitted it often is, up to what size of company generally speaking does it pay?

Mr. Gill makes a point that the holding company does not buy a gas company lock, stock, and barrel, but acquires a majority holding of its shares. That is a distinction with little practical difference. The shareholders of the holding company through their directors entirely control the subsidiary company and can do with it what they will—and those shareholders are not usually local, but are believed to be largely corporations or companies interested entirely in finance. Although it may be impossible for the holding company to obtain larger yields from the subsidiary companies by raising the price of gas, it is, of course, quite possible by reducing the price of gas. This can be done for a limited period owing to the inherent strength of the Industry by reducing normal expenditure. The shares of the holding company can be thereby enhanced and sold at a substantial margin of profit—with, of course, an inevitable day of reckoning for someone. I am not suggesting that it is being done, or that there is any intention of doing it. But that is the danger that is feared, and there is no present safeguard against it in many cases. The gas minded technical directors are virtually, I would say with respect, nominees of the financial interest. The only safeguard is where the financial control itself is in the hands of a large gas undertaking.

Mr. Gill describes a system of a high grade staff operating over the network of subsidiary companies, and one can easily realize the great value this must be to small companies. But among the groups concerned there are apparently two companies making over 500 million cu.ft. of gas per annum. One would doubt if this general staff would be of so much value to them, and one would expect it to be of no value to undertakings making, say, 1,000 million cu.ft. per annum. One can see, however, much value to a holding company to have within its groups companies of this size.

Out of Touch with Realities.

A central staff, if I may so term it, is in danger, more particularly in some cases such as the carbonization specialist, of becoming a body of experts who advise but are out of touch with daily practice and so a little out of touch with day-to-day realities. If the general staff of a large undertaking is made available to small neighbours the danger disappears. This entails quite definite geographical grouping which should be the basis of any successful holding company scheme. Such can be to the advantage of the large undertaking. It is a definite disadvantage to any undertaking, however large, to have less efficient undertakings operating on its borders, and any holding company scheme which improves this position must be to the advantage of the large undertaking.

While one would not be too critical of the good work that has been done in the comparatively short time that has elapsed since the commencement of these rapidly growing schemes, one would anticipate difficulty with the travelling salesmen unless very close geographical grouping were exercised. The personal knowledge by a salesman of the consumer's individual personality is of so great importance, and almost equally the salesman's instant availability. One would like to hear from Mr. Gill if any difficulty does arise from the absence of expert sales advice and service in the intervals between the travelling salesman's visits to any particular districts. One is also surprised to read that in groups of this size the industrial gas representative does not find his time fully occupied upon industrial gas work.

The closest scrutiny will be given probably to Section V of the Paper relating to the levy of the holding company upon its subsidiaries. In the case of a company selling, say, 30 million cu.ft. per annum, the holding company would take in addition to the directors' fees a levy of approximately 1 per cent. on its capital and over 1½d. per 1,000 cu.ft. of gas sold. Such an undertaking might benefit to this extent and might also effect savings on its purchases to the extent of the further buying commission, but surely not more. The resulting net benefit, therefore, is one of service to the consumer and stability of business.

In the case, however, of a Company making 500 to 600 million cu.ft. of gas per annum, the holding company would take in addition to the directors' fees a levy of some £1,000 per annum, which might equal ¼ per cent. on its total loan and share capital, or ½d. per 1,000 cu.ft. of gas. In addition there is a levy of 2½ per cent. on all goods bought under special contracts, which it may probably be assumed are, in fact, if not nominally, compulsory on subsidiary companies, and 1¼ per cent. on coal contracts made, which again presumably in practice are usually made by the holding company. This does seem to be an excessive price for such a subsidiary company to pay. It is very much doubted if an undertaking of this size obtains £1,000 worth of benefit but rather bestows it, and it is also doubtful if 2½ per cent. can be saved upon buying in bulk over the price obtained by a 500 million cu.ft. company, and certainly not 1¼ per cent. on coal. Do the holding companies with which Mr. Gill is associated succeed in making contracts, for instance, for meters or perhaps high grade cookers at a price saving more than 2½ per cent.?

No Reduction of Initiative.

There has been a fear expressed that the holding company would react unfavourably upon the engineer, reducing the scope of his initiative. But it would appear on the surface that the contrary must be the case. The directors of the subsidiary company, nominees of the holding company, cannot be in such close touch locally with the undertaking's peculiar requirements, having less time maybe and being far removed geographically in their daily pursuits as compared with the original directors. More responsibility for development locally must surely fall upon the local engineer. The holding companies schemes seem to me to call for an ever higher ability in the engineer and manager of a gas undertaking than in the past with the additional ability to co-operate.

Mr. Gill makes no mention of any steps taken to co-ordinate the general policy and working of the subsidiary companies while meeting at the same time their peculiar needs. With close geographical grouping the attainment of common policy—such as in sales prices, goods, and service—must be an immense advantage, but past history and local peculiarities cannot be ignored entirely.

This is a matter which I submit would be difficult to settle in the short time available at board meetings when so many are held normally on the same day. It would appear to be highly desirable that the local engineers in a geographical district should form advisory committees to discuss at quite frequent intervals with responsible directors matters of this kind. It would be interesting to hear from Mr. Gill if this, in fact, obtains.

In conclusion, I think the Companies with which Mr. Gill is associated are to be congratulated among others for refuting some of the fears which the formation of holding companies aroused and for making a real contribution to the improvement and strengthening of the Gas Industry in the districts in which they operate.

A New Messenger Needed.

Mr. CLARK JACKSON (Neath): The Gas Industry, like all other major industries, has always had room for a man or a body of men prepared faithfully to deliver the message, which in our case can be interpreted as service to the community. I feel sure no one will deny that in this respect many have fallen by the way in the past; lassitude, indifference, lack of faith, and even down-right laziness has dimmed the original vision of youth, so that particular undertakings or groups of undertakings have not served the community as they originally intended to serve. I say definitely we all know cases of this description and we know how they have in the past reacted to the detriment of the Industry in general. A new messenger is required, of somewhat stronger calibre than

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the old one probably, and provided—I do emphasize this point—that the holding companies will work with the vision such as that of Mr. Gill's Company, as typified in his Paper, no one will deny that the holding companies are bound to confer great benefit upon the Gas Industry in the long run.

In the case of probably a few of the larger undertakings and certainly of many smaller undertakings, the benefits conferred by a holding company, as outlined by Mr. Gill, are manifold. Opportunity is given to the central control to analyse carefully the costs of production throughout the various works; the efficiency of the whole of the processes of the production of gas is carefully scrutinized by an independent person or persons from the central office and the results are tabulated and sent round to the various undertakings. There is then a certain amount of competition between the various works to improve their own particular results. Further, where any individual undertaking is facing very intensive competition from the electrical or any other industry, the holding company is in a position to spend money wisely and effectively in the district of that undertaking for the purpose of placing the undertaking on its feet. Those of us who have had to deal in our various capacities with large numbers of smaller companies operating in particular districts appreciate how disheartening the past few years have been to many of them, and particularly in the depressed areas the Directors of such undertakings in some cases have almost thrown in the sponge. That is where the strength of a holding company is so valuable.

A matter which I have not seen mentioned in Mr. Gill's Paper, however, is that of service to the individual consumers. In my vision of the holding companies I see a group of trained men and women inspectors going round from company to company in the group, servicing the whole of the consumers of each undertaking in turn, and then starting again at number one. Holding companies can do that, whereas probably small individual undertakings cannot. That particular type of service, as I have experienced it in the past, is of the greatest possible value to the undertaking.

I trust that the holding companies will not insist upon asking managers to make out returns which are too complicated, particularly the managers of the smaller undertakings. When the manager of a small undertaking, who has many duties to perform, is asked to fill in a very long form, he is inclined to regard it as a nuisance; and I quite agree with him. Finally, I would query the charges mentioned in the Paper for professional services; I think they are somewhat on the high side for individual companies. However, that is a matter on which I am not prepared to offer any severe criticism, having regard to the many advantages which the holding companies offer to the individual units.

The Views of the Subsidiary Company.

Mr. C. R. Ingham (Cannock): So far we have had a discussion with regard to a holding company as looked upon from above by the Directors. I propose to give you the views of one who is an officer of a subsidiary company. First, I would mention the problem of maintenance. One of the first things that a holding company does when it takes over a subsidiary company is to have the gasholders examined, and the examination of some of the holders has revealed astounding defects. A gasholder erector is a servant of the holding company with which I am connected, and I am sure he will prove to be of very great service. In connection with one gasholder repair job, I consulted the holder manufacturers and was informed that the cost of the work would be about £150. We did the job ourselves, however, with the aid of the gasholder erector employed by the holding company, and the cost was about £34.

In Gas Consolidation there are five gas companies within a radius of about ten miles which are working together, quite apart from the direction of the holding company or control by its special officers. The chief officers of the undertakings hold regular meetings and discuss means whereby we can help each other; and, of course, inasmuch as we are all under the control of a holding company, it is so very much easier for us to work together than it is for undertakings which are not so controlled. For example, the selling prices of gas appliances are the same throughout the whole district. When we wish to introduce new leaflets, we simply order them for the whole group, and we have them over-printed with our various showroom addresses, and so on. Window displays for showrooms are arranged by one undertaking, and every week or fortnight a motor lorry moves a display from one showroom to the next; it covers ten or a dozen showrooms in the course of a day, and each undertaking has a first-class window display service, such as it could not possibly have if it were working entirely independently. There are also items of works equipment which associated undertakings can secure; for instance, oxide disintegrators, power hammers, and that sort of equipment can be taken from one undertaking to another. We are also considering the engagement of a cookery demonstrator to work in a small area of about ten miles radius.

Generally I have found that on the advent of a holding company the local Manager is not deprived of initiative or control. Very definitely he has more responsibility than he would have in a municipal or ordinary company undertaking, and I think that that is all to the good. So far as the holding company with which I am associated is concerned, there is no fear of depriving the local Manager of initiative or control. There is much less red tape, there are no committee meetings, sub-committee meetings, and so on; the Manager can get on with his job and has every encouragement to do so.

The problem before us is that of increasing the sales of gas per consumer; there can be no doubt of that. Many of the small companies in particular have plodded along year by year, losing ground and losing heart; but the holding companies, so far as I have been able to see, are putting new life into them. I think the holding companies are a perfect godsend to many small companies and to some of the larger ones.

Travelling Staff.

Mr. D. B. Parkinson (British Gas Light Company): There is no doubt that a staff of travelling experts in all branches of engineering makes for excellent service and efficiency in the various undertakings, but a large whole-time travelling staff must necessarily be rather costly. While it is a great advantage to the Managers to have this staff to call on when they are in need of advice and assistance, is there, perhaps, a tendency for regular routine control by them to destroy the Manager's initiative and his care for the expenditure at his undertaking?

In the British Gas Light Company many of our small works are situated near a larger works and mechanical or other assistance can be obtained when required from them. It is our policy to have, in many cases, one Manager supervising a group of three or four undertakings with a competent works foreman at each place. Returns are sent every week to the chief office and collated and any undue variations in the working results can be noted and assistance or advice can then be given.

We have found, in the same way as Mr. Gill, that travelling salesmen are extremely useful in boosting up the sales of an undertaking, particularly when it is first taken over, and it is often necessary to import extra fitters to install the large quantity of apparatus which is being sold. The introduction of an industrial gas salesman would certainly seem to be an advantage. As Mr. Gill remarks, time alone can show what is the best system to adopt to promote the highest standard in dealing with these smaller undertakings.

Lack of Utilization Service.

Mr. C. A. Masterman (Gas Light and Coke): To anyone who is reminded daily of the immense variety of technical and scientific problems which are presented in connection with the use of gas, it is a matter of some surprise to find no reference in Mr. Gill's Paper to the methods whereby holding companies' organization can meet these problems. The public is unprepared to buy gas as a commodity but only as the service which gas can give, and between providing a commodity and a service there lies the world of difference. Failure in service may be due to the apparatus, to the fittings, to the way in which the apparatus is installed or maintained, to the consumers, or to the quality of the gas supplied. Close co-operation with the appliance manufacturers can reduce failures due to the apparatus. There remain, however, many day-to-day problems, together with those of ensuring adequate standard in the deliveries of materials and an adequate standard of technique among the fitters.

The Author refers to the technical services which the holding company can provide to the subsidiary companies in connection with the manufacturing process, but on the utilization side any such service appears lacking. The only reference in the Paper on this subject is where it is stated that these particular holding companies belong to the Midland Industrial Gas Centre. It is not clear that the existence of the holding company has contributed in any way to the contact between the subsidiary undertakings and that Centre, nor is it clear whether domestic utilization technique is catered for in this contact. To the small or even medium size undertaking, the provision of sufficient technical staff to deal with the wide variety of utilization problems is financially impossible, but by the co-operation ensured under a holding companies scheme it is to be hoped

that these problems might find solution. It must, of course, be recognized that many of these holding companies have been in existence a very short while, and it may be unfair to expect them to have built up in that short period an organization to deal with routine testing of deliveries, training of personnel, and the solution of day-to-day technical problems, such as must be solved if satisfactory service to the consumer is to be ensured.

It would be interesting to hear from the Author in his reply his proposals as to how this vital need will be accommodated.

Grouping by Amalgamation.

Mr. H. C. SMITH (Tottenham): This discussion has overflowed the rather narrow boundary suggested by the title of the Paper, and although I have no experience of holding companies, I have had some little experience of grouping by amalgamation. Everything we have been told this morning about holding companies shows that when a holding company absorbs or controls a smaller company, it immediately begins to spend more money. Where is that money coming from? We are told it is coming from increasing sales to the consumer. Well, from my personal experience of grouping, I should like to see the increasing sales to the consumer providing sufficient increased revenue to meet the extra expenditure which the holding company is going to incur in looking after the small undertaking which it is taking over. It is suggested that savings will be effected in the purchasing of materials. There are, certainly; and the holding company will take some of that at any rate. The holding company will also charge for professional service. My own Company has taken control of nine other undertakings. As soon as we have been able to get 100 per cent. control we have amalgamated those undertakings with the parent undertaking, there is physical contact at the boundaries and we have shut down six gas works. The savings effected in manufacture by closing the six gas works and linking up has given us something to spend on the districts of the undertakings we have taken over. If we had not effected those savings I do not know where we should have obtained the extra money to meet the extra expenses on the district. What bothers me is to know where a holding company is to obtain the money with which to meet the extra expense to which undoubtedly it will be put if it is to treat the sales side of the smaller undertakings as it should be treated. No doubt those who are running the holding companies have a satisfactory explanation as to whence this extra money will come.

There is another factor, as I see it (as I have no experience of the holding companies I may be quite wrong). Their sources of revenue are the dividends which the individual companies they hold are entitled to pay, and those dividends depend on the selling prices of gas. The majority of the individual companies have never yet had their standard prices reviewed. What will happen when those standard prices are reviewed only the holding companies, I suppose, can say. Some of us have had our standard prices reviewed twice already; but in the areas of the smaller undertakings there is nobody very strong who will take any interest in the standard prices, and the Board of Trade is not asked to review those prices. But if the standard price of a small undertaking which is controlled by a holding company is reviewed and increased, down goes the income of the holding company. It does seem to me that where an undertaking is large and progressive enough and has around it some smaller undertakings with which it can amalgamate, it is far more satisfactory in all respects for that larger undertaking to carry out a proper amalgamation with the smaller undertakings than it is for those undertakings to be bought by this or that holding company. That is my personal view, and I am sure that those who are interested in holding companies will not agree with me. In our own case the whole undertaking is managed by one Board of Directors, but we do insist that the local Managers shall retain their initiative and individuality—a factor which I am perfectly confident is most important, whichever course is followed.

The Author's Reply.

Mr. GILL, replying to the discussion, said: It is suggested by Mr. Smith that those who are interested in holding companies would not agree with his idea that it is better for a large company to amalgamate with a number of small neighbours than for those small undertakings to be taken over by a holding company. But in fact I agree with him; I think that the amalgamation of a large company with its smaller neighbours is the best course of all, better than being taken over by any holding company. I want to make that quite clear.

I agree cordially with Col. Carr that the man on the spot is really the important man. We are very anxious to support such men in every way and to make their jobs more interesting; we want a thoroughly friendly atmosphere, and we want to be helpful and to give service. I am not sure that Col. Carr is not right in his mild criticism, when he says I have shown that we are doing more on the technical side than on the sales side. I think that the development will be in the direction he has mentioned. At the same time, I do think it is important, when you take control of a company, to ensure that the gas is right. Let us have the product right first. That is a technical problem. Again, it is of no use having a sales campaign on the district if the pressure is not sufficient; so that you must ensure that there is pressure right through the mains. It may mean some looping up and some alteration to get the gas quality and the pressure right; then you can start on your selling campaign.

I was very glad to hear the remarks of Mr. Holmes Hunt, who has vast experience in this direction, though on very different lines from our own. I shall have to deal with Mr. Briggs' remarks in writing, but I am glad to have his criticism, because criticism is very useful. It has been a wonderful education to hear all the ideas that have been expressed, and I am looking forward to the opportunity of applying some of them in practice.

(Mr. Gill intimated that he would submit a more extended reply to the discussion in writing.)

THE FUTURE OF Gas Appliance Design

Communication No. 158

by
C. A. MASTERMAN
(Chief Technical Officer, Gas Light and Coke Company)

Mutual Co-Operation.

Mr. H. JAMES YATES: I think you will all join with me in offering Mr. Masterman our heartiest congratulations for so ably giving us a review of the progress in the Gas Industry during the past 10 years, and the views he has expressed regarding probable future developments. Co-operation between gas undertakings and the appliance manufacturers cannot fail to be of the greatest value to the Industry, and the establishment at Watson House of Research Laboratories and experimental departments has been of undoubted assistance to makers of gas apparatus. To those not associated with the production of new appliances it may seem to take a long time to effect progress in gas-consuming apparatus, but the problems to be dealt with concerning both design and manufacture are numerous and often difficult to solve. In the development of all new things much spadework has to be done and frequently the high ideals at which we aim do not always prove to be practical or commercial propositions. I know this only too well, because I established Research Laboratories in our works over 40 years ago.

Take gas fires, for instance. The first columnar radiant was put on the market as far back as 1908, nearly 30 years ago. Since that date this type of radiant has been developed and improved, and by careful attention to detail and continuous research on materials used for bricks and radiants, combined with increased accuracy of manufacture and assembly, the radiant efficiency of the modern gas fire has been raised to double that of the pre-1908 fire.

I want to tell you that many years ago I coined the phrase "The radiant must go." Perhaps in those early days it was rather an optimistic ideal; nevertheless, this conviction has grown upon me so strongly that I am prepared to make a definite prophecy by saying "The radiant as we know it will go," so enabling gas fires of an entirely new design to be offered to the public.

A further example of work extending over a number of years, and which has not yet reached finality, was the investigation, begun in 1924, of the factors influencing the quality of energy emitted by radiant heaters, correlated with the study of the effect of energy of different wavelengths on the human body. As a result the quality of the radiant heat was improved and attention was drawn

to the value of the increased proportion of short infra-red rays. Another important development made in gas fires was the raising of the hygienic standard by a realization of the importance of ventilation—a research which took place before the War and which was summarized in a communication read before the British Association in 1915.

The elimination of the primary air sleeve from the burners of gas fires and the introduction of calorific value and pressure regulators marked another step forward and removed many of the troubles with which gas undertakings had to contend. The modifications in the design of burners and injectors required to eliminate noise also necessitated research extending over a number of years, and the absence of unpleasant noise in the case of gas fires has been taken for granted for a long time past. Then in the immediate post-War years the general investigation was made of the factors which determine complete combustion of the gas used in all types of domestic gas apparatus.

Cooking and Dietetics.

Mr. Masterman has referred to the gas oven with the bottom flue outlet and the humid cooking atmosphere in the oven, with thermostatic control. The Great War held up development work on cookers, but the "New World" cooker with the "Regulo" was introduced to the public in 1923. This was undoubtedly a great step forward, and I might say almost revolutionized the gas cooker. There are many other interesting and historical facts I could mention, but I will not take up your time.

While great improvements have been introduced into actual cooking appliances, the study of Dietetics, I am afraid, has not been undertaken by many. This subject, however, is of vital importance, and the establishment of Research and Demonstration Kitchens, and the training of expert cooks is becoming a great asset to the Industry.

I should like to take this opportunity of referring to a great difficulty that really does arise as a result of the introduction of new designs. Frequently there is no real material advantage gained. What do matter are utility and efficiency, and if minor improvements can be embodied in existing designs, the position for Gas Undertakings is simplified. Take the case of the gas cooker. In recent years a large number of new cookers have been placed on the market, but broadly speaking they are reproductions of existing designs with slight modifications. A design should only be introduced if it possesses some distinct advance in utility and construction. Changes in apparatus create great difficulties in production, particularly if the old types of apparatus are still in demand by gas undertakings, as well as the new ones. Variety of patterns adds to the cost of apparatus and reduces output.

I am glad that Mr. Masterman has made such direct reference to the importance of gas quality. In the days when I was able to attend meetings I used to emphasize the advantages to the appliance makers of constant quality and pressure, and a low sulphur content. That, of course, is the ideal, but the ideal is not always attainable. Nevertheless, we are getting nearer to the ideal, and this will greatly assist the manufacture of gas apparatus and will also relieve gas undertakings of many of their difficulties by reduction in maintenance charges. Gum formation is also troublesome, but no doubt in due time this will be overcome.

Now as regards future developments, Mr. Masterman has made a most interesting and valuable forecast and has rightly laid special emphasis on the fact that it is the service which gas is capable of providing that will determine the progress of the Industry. I am in full agreement with him that the needs of the community and a rising standard of life will call for both new applications for gas and developments in existing types of apparatus. In the endeavour to meet these needs, I suggest that whole-hearted co-operation must be the motto for the supply side of the Industry and the appliance manufacturers.

Mr. Masterman's Paper is of such wide scope that it has only been possible for me to deal with a few points. I am sure I shall be expressing the feelings of everyone here to-day in tendering my thanks to Mr. Masterman for the Paper he has presented to us. We all, I feel confident, share with him the belief in the great future before the Gas Industry.

Supply of a Standard Gas.

Mr. E. V. Evans (South Metropolitan): Perhaps you will allow me to speak, not so much as an official of a gas undertaking, but rather as Chairman of the Joint Committee of this Institution and the University of Leeds. In particular I wish to deal with Mr. Masterman's plea for the supply of a standard gas. The work that has been carried out at Leeds falls under two headings. In the first place, we are investigating various aspects of the process of hydrogenation, which to-day is being applied in the chemical industry, to ascertain to what extent, if any, the Gas Industry can use it to advantage; and, incidentally, in this matter I think I can promise that some most interesting work will be placed before you at the November research meeting of the Institution. The other part of our work is concerned with a thorough study of the combustion characteristics of various gases, and the ends that we hope to achieve are the simplification of the design of appliances for use in the Industry, the evolution of burners possessing the widest range of useful service, and also—and perhaps this is the most important of all—information to show the gas manufacturing side of the Industry the type of gas and the limits of variation allowable.

As you know, the calorific value, the density, and the pressure are the three variants which matter most in determining the effectiveness of the gas in the burner. Another important consideration is the proportion of methane, hydrogen, and carbon monoxide in the mixture. I believe the time will come when all gas undertakings will find it desirable to ensure that the gas that is made from day to day and from hour to hour conforms to standards which are a good deal narrower than those at present considered necessary. In the opinion of some it may be that the gas undertaking that I serve has too rigidly controlled the gas supply to its district by maintaining the chemical and physical characteristics within too narrow a limit. If we have done that, it is perhaps pardonable, because to-day in our district of supply difficulties concerning the performance of appliances do not arise. When an appliance fails to give full efficiency it is the appliance that is at fault, not the gas.

No accountant on earth could determine what this means in £ s. d. I know, however, that the deviation from a standard gas in many parts of the country is really too great, and I believe that officers responsible for the district of supply in future will demand that a more constant gas be made for them for distribution. Many of our first-class brains have been devoted to producing gas cheaply, and there is to-day a very interesting race between the manufacturers to produce a therm of gas of a certain calorific value at a fraction less than a competitor. Unwittingly, the advantage of that fraction less may be much more than counterbalanced by the trouble involved in the manufacture and subsequent control of gas appliances. A gas of, say, 500 B.Th.U. per cu.ft. may be made in very many ways. It may have a density between 0·4 and 0·6, the methane content may be between 18 and 25 per cent., and the hydrogen content between 45 and 55 per cent. Then it may have a thermal discharge at the burner head which may vary, under the same pressure, in the ratio of 100 to 125. It is really impossible to expect appliances to behave effectively with such variations. It is not enough for a gas undertaking to regulate from time to time the degree of steaming a charge, or the percentage of water gas added, or the amount of oil used, by consideration only to the cost of manufacture.

If the Research Executive Committee of this Institution is able to place before the Gas Industry a carefully prepared case showing the absolute necessity for standardizing the chemical and physical characteristics of the gas supplied to its consumers, I am confident that gas engineers and gas chemists and the designers of gas-making plant will find a way to meet that requirement.

Women and Appliance Design.

Mr. W. W. Townsend (Colchester): In this Paper there seems to be one important omission. From end to end of it I can find no reference to women! It may seem strange that I should draw attention to that matter, but I think everyone must admit that women will play an increasing part in the future design of gas appliances, as they have played an increasing part during the last few years. I am very pleased that Mr. Masterman refers to one of the things to which we may look forward—*i.e.*, the development of the auto ignition gas cooker. Women's influence is apparent there. The average man carries matches wherever he goes, even if he is a non-smoker; but the average woman does not carry matches, and she is bothered when she has to find them. It is by no means unimportant that so far as we can we should make gas appliances self-igniting. We have already found the benefits of that in the case of gas fires.

I think the assistance of women would be of advantage also in connection with apparatus for certain cooking operations, notably grilling. I am very pleased to note that Mr. Masterman draws attention to the need for an improved type of grill. He refers to the fact that there

is a large demand for a gas hotplate, to be placed on top of the electric cooker in order to make up for the deficiencies of that instrument. It is a great pity that when an opportunity such as that occurs, in very many, and I believe in the majority of, cases, the hotplate provided simply consists of a couple of boiling rings. You are thereby inviting the consumer, the woman, to use the electric grill, which is one of the most satisfactory parts of an electric outfit, and it is high time that the Gas Industry really got down to the task of designing an efficient, quick, and effective grill for use in the ordinary home. That should be provided as part of the equipment in such a case as has been mentioned, as an addendum to the electric cooker. I know it has been objected that it is of no use providing the consumers with a gas grill, because they will not use it. But there are two answers to that. One is that the present type of gas grill is inefficient; it is a regular trap for grease, and the housewife does not like it. The other answer is that the ordinary housewife does not know enough about the use of a grill. Inasmuch as most of us have the services of cookery demonstrators, it is our job to show housewives that effective cooking can be done with the grill.

I am very pleased to know that Mr. Masterman has put in a good word for the storage type of water heater. I think we are very apt to have fashions in appliances as in apparatus, but a recent fashion has been the instantaneous type of water heater. I admit that it is very useful, but Mr. Masterman puts it in its place in his remarks on the subject.

In connection with the ever-increasing load for the sink water heater, I cannot for the life of me understand why gas undertakings should display a preference for the instantaneous heater. If you are to provide water heaters, which consume anything up to 80 cu.ft. per hour, in thousands of houses, many of them built years and years ago, you will probably have to re-pipe the premises; at any rate, you have to install a large enough pipe from the meter to the scullery. Then you have the problem of the combustion products. It is said that if you burn gas at the rate of 80 cu.ft. per hour for only a minute or two for sink water heating, the products of combustion do not matter. But, on the other hand, there is available a storage type of heater which will give two gallons of hot water for washing up, the appliance consuming only 10 cu.ft. an hour, which consumption can be carried by any house carcassing system, and any meter. I have been able to do a considerable amount of business in that direction with the storage type of heater; the number runs into well over four figures, and they have given universal satisfaction and could be fitted anywhere. They are rented on simple hire, which system I still believe in for certain types of apparatus, particularly when I have to compete with electrical apparatus which is rented on simple hire. We fix the apparatus free and charge a low rent. The drawback is that we find, on taking out the figures, that on the average the sink water heater does not increase the consumption of gas, or increase it only very slightly, and in some cases there is actually a decrease in a particular consumer's consumption. So that we are really philanthropists! We go to all this trouble to provide people with a service which will actually save them money and reduce the consumption of gas. Nevertheless, I think we are doing the right thing, because we are consolidating our business. The reason is perfectly obvious; the people need hot water for washing up, and so on, and previously they used some very large vessel on the hotplate of the gas cooker, whereas now they are heating the water far more efficiently.

Problems Occasioned by Water.

One trouble with all water heaters, and one which is worthy of a certain amount of research and investigation, is the effect of the different types of water with which we have to deal, as mentioned in the Paper. Not only do we want gas which is free from sulphur and from various other things, but we also want water which is free from many of the products with which it is now laden, and which are producing very serious problems.

Finally, I should like to refer to the industrial centres and the large scale and industrial uses of gas. Yesterday we heard a great deal about the holding companies; but those of us who do not enjoy the blessings of being controlled by a holding company—and there are still a few—need not lose heart. It is not for us to have a dozen different experts sent down to our works at different times to put us in the right way, but we can achieve very nearly as much by the co-operation for which facilities are now available. Only last week I had an instance of that. We are members of both the domestic centre and the industrial centre of Watson House. We had an enquiry for business which we had really created, the conversion of some bakers' ovens to gas firing. We had never done such a thing before, but an expert from Watson House came down, we secured the order and we are now fitting the apparatus. It means a consumption of about 5 million cu.ft. per annum. In many cases of that kind we have taken advantage of the information available at Watson House and of the services of the experts there, and I cannot speak too highly of their ever-ready co-operation in any matter of this kind. I wish to tender my thanks to Watson House and to the Gas Light and Coke Company for the help they render in that direction.

An Augury for Future Prosperity.

Mr. Dean Chandler (South Metropolitan): In recent years there has been a great effort on the part of the Industry in general to explore and exploit new and profitable fields in gas utilization, and the active part the Author and others have taken, and are taking, augurs well for its future prosperity.

The real urge behind all recent development in design and utilization is the demand for better appliances and better service, and the competition which faces the Gas Industry. Makers of appliances have been very alive to these matters and great credit is due to them for what they have done and are doing to help the Gas Industry. We should not forget that in some notable instances inspiration has undoubtedly come from abroad, and the valuable lead given by our friends from across the Channel is now being followed at home.

In the matter of new appliances, it is, of course, essential that apparatus should not be released for general use until it has been fully tried out. Especially is this the case with innovations concerning which there may exist some uncertainty regarding their performance in everyday service. In the case of my Company, before such appliances are generally marketed, they are thoroughly tested by some of our own people, and on a reasonable scale and for a reasonable period of time.

As to space heating, the Author remarks that flueless heaters of safe and reliable design and attractive appearance have been introduced in variety. Surely, the matter of importance is the reliability, safety, and comfort of such appliances in use.

The Author's reference to new types of central heating boilers prompts the remark that it is most important for the Gas Industry to insist that gas-fired boilers must have a satisfactorily safe overload margin, and the rating of boilers must be on a satisfactory basis. Units have been marketed much over-rated in the matter of their heat output, and this has led to trouble. The matter is now having serious attention, and I hope makers of boilers will deal fairly in this matter. When trouble occurs it is the gas which is blamed and not the appliance. Much harm can be done to the Industry by the use of gas boilers with inadequate heating surface, and unsatisfactory flueways.

In Section 5 of the Author's Paper are given reasons why gas should be increasingly used in preference to electricity for purposes where heat is required. The Author's arguments are probably sound, and were matters of national economics taken into full account, and were fashion and fancy placed in their true perspective, they would no doubt influence public opinion in favour of the use of gas. The Author suggests that some of the charges which electricity supply undertakings are able to make are anti-social and constitute exploitation of the community, and he suggests that this is a matter for effective protest. I suggest that it is our business to recognize the facts as they are and meet them with our own effective weapons. Let us make no mistake about this. If we resigned the field of lighting we should make it easier for the electricity undertakings to charge a still higher rate for lighting in order that they might decrease their charges for the other processes in which they are in competition with gas. We must therefore do all in our power to lay stress on the points on which, as we know, gas is superior to electricity for lighting, whether in the street, factory, or home. One cannot help thinking that the substitution of electricity for gas lighting is a menace in that it might assist the supply of electricity for other domestic purposes. I agree with the Author that in burning gas for the production of light, enough has not been made of the fact that the incandescent system of gas lighting is also a system of heating, and this is of value. I was always impressed by Dr. Carpenter's description of the incandescent mantle as a miniature sun shedding its light and warmth in every direction. The fact that the rays from the metal filament used in the electric bulb, when raised to a high state of incandescence, are more injurious to the sight than the softer and less actinic rays of the incandescent mantle has not been sufficiently stressed. The Author states that " the Gas Industry will

be serving its own interests by remaining an effective competitor in the lighting field." This is unquestionably true, and one hopes that the Industry as a whole will take steps to show its sincerity in this important matter. One cannot help thinking that had the Industry ten or fifteen years ago instituted an intensive, thorough investigation by some competent body, at Leeds or elsewhere, with a view to placing lighting by gas on a more satisfactory basis, the reward to the Industry which would have accrued from some epoch-making discovery like that of 40 years ago would indeed have been great.

Gas Taps and a Standard Specification.

The Author refers to gas taps, where it is stated that too little attention has been paid to their design and manufacture. Discussing this matter with the Author some months ago, I suggested that the time had arrived when gas taps might well be the subject of a standard specification. A strange variety of taps is now being marketed—some turn to the left, some to the right, to open the gasway, some are half-nited, some quarter-nited, and again some are still provided with the old-fashioned wire peg for a stop. The gas tap is one of the most important pieces of gas apparatus in use, and as such deserves the careful attention of the Gas Industry.

Referring to gas burner design, the Author suggests that the use of non-aerated flames has not been fully exploited. I think there can be no question about this. I have long held the view that in the case of gas oven heating the non-aerated burner would be more satisfactory than the aerated type. We have recently adopted non-aerated gas flames in wash-coppers and large boiling pans with great advantage, and, in fact, I have long expressed the opinion that there is no fundamental reason why this type of burner should not be used to good effect for many purposes, including the cooker hotplate, excepting, of course, the grill. Non-aerated flames are already widely used for industrial furnaces.

In the matter of gas oven construction there can be little question that hitherto a far greater weight of metal has had to be heated than is really necessary, and the probability is that the cooker oven of the future will be much lighter in structure and the lagging will be effected largely by jacketing with the waste gases. For a luxury type appliance the cooking oven will in all probability be externally heated, with an easily removable box for the oven. Loss due to radiation from the containing walls of a gas oven may in future be minimized by the use of polished metal surfaces, which can be extremely effective in conserving heat, and there is no reason why boiling burners should be the cumbersome pieces of cast iron which they generally are.

Referring to Table 4, I might mention that I had some months ago to go into the question of fuel costs in various types of households in much greater detail than has been necessary for the Author's Paper, and it will no doubt be of interest that my results are in substantial agreement with the Author's " average household " on the matter of fuel cost. I suggest, however, that the " average household " is purely mythical and a dangerous and misleading conception. The " average household " should be buried with the " economic man " so much beloved by economists. This view is clearly borne out by the Author's Table 1, in which he divides the gas used by the average consumer between the various household operations. For instance, water heating is credited with 9 therms a year, which works out at about 1¼ gallons of hot water a day for a household of 3 or 4 persons—or about 2 gallons of bath water. This same household uses each day about 1½ gallons of water boiled in a kettle. Apart from the cooker consumption, the apportionment of the gas used is almost a matter of impossibility, as variation from case to case is so wide that an average consumer does not exist, and, I think, cannot exist.

Apropos Mr. Townsend's interesting and important remarks on water heating, we must not forget that the instantaneous type water heater has placed in our hands an appliance with which the electricity supply authorities cannot compete. While on the subject of electricity, I would point out that although Mr. Masterman has referred to the Battersea power station as having an efficiency of generation of 28·59 per cent., the figure for 1936 was 29·14 per cent., and I believe that even higher figures are being realized to-day.

Standardization of Calorific Value.

Mr. G. M. Gill (London): In the section of the Paper dealing with the future of gas utilization Mr. Masterman records a sort of pious hope that gas might be standardized at one calorific value. I would go just a little further than a pious hope, however, and express a lively expectation that some day we shall achieve that state of affairs. As a gas maker, very rarely have I come across cases where I should say that a standard of 500 B.Th.U. per cu.ft. would be actually detrimental to the undertaking in any way. In other words, I believe that the vast number of gas undertakings could declare a standard of 500 B.Th.U. without incurring a loss, but in many cases effecting quite a gain. Certainly with horizontal retorts there should be no temptation whatever to declare a calorific value less than 500 B.Th.U., and I believe that in the majority of the vertical retort plants we can make just as cheap a therm at 500 B.Th.U. per cu.ft. as at a lower calorific value. In one company I have in mind the declared calorific value is 500 B.Th.U., using modern continuous vertical retort plant, and the results are extraordinarily good.

Just to show how easy it is to make a gas of high calorific value, I would recall that when I was in the South Metropolitan Gas Company we came to the conclusion that it was really necessary to pull quite hard on the retort house in order to bring down the calorific value of the gas to 560 B.Th.U. But there we spent a long time tightening up the efficiency of the retort house, finding out where the diluents were going in, in the form of air or waste gases, and stopping them, until we found that gas as it should be made is of comparatively high calorific value.

A man who increases the calorific value of the gas he makes from 450 to 500 B.Th.U. per cu.ft. secures quite an advantage in a very important respect. He secures 11 per cent. more capacity in all his works plant—condensers, washers, scrubbers, purifiers, and so on, and in the holders, in the gas mains, services and meters and in the pipes in the houses. Mr. Townsend has said that an instantaneous heater using a large amount of gas is of advantage; and I think the actual cost of gas into the holder is more likely to be lowered than increased in the majority of cases. I know there is the snag that, instead of selling 20 cu.ft. of gas for a penny at a calorific value of 450 B.Th.U., we are able to sell only 18 cu.ft. of 500 B.Th.U. gas for a penny. But that is a matter which needs to be faced boldly because, after all, therms indicate the true value of the gas. I for one should vote in favour of a standard calorific value, because I believe that in the long run it would be of great value to the Gas Industry.

The Author's Reply.

Mr. Masterman, replying to the discussion, said: There is not time to go into the question of storage *versus* instantaneous water heaters, but I should like to challenge Mr. Dean Chandler in putting forward instantaneous heaters as the favourites merely because the electrical people cannot compete. I think that is an extremely feeble reason; and there are very much more substantial reasons in favour of the opposite system in many cases. The use of a non-aerated burner in the cooker oven seems a very common-sense practice; but there is one small snag within our experience. Surprising as it may seem, the ordinary so-called luminous flame burner in the cooker is really a more difficult criterion against which the user can judge visually as to gas rate than is the aerated burner. I am inclined to think that if the cook is called upon to set the heat input by eye, the older aerated burner is a better instrument for the purpose.

I got into trouble over the " average consumer," and I know that I asked for trouble. But it is more convenient to express the matter on the basis of the average consumer rather than per 100 consumers, and I am quite sure Mr. Dean Chandler has secured from the table all the meat that I intended to put into it.

A standard calorific value has been advocated strongly by Mr. Gill, and naturally, it is a great help on the utilization side. But the utilization side will not be thankful for the provision of a standard calorific value gas up and down the country, if it is provided at the expense of a varying specific gravity and a varying flame velocity in the gas. I think we should all like to compromise. Let us get as near as possible to a standard everything; but if the calorific value of the gas supplied has to be different as between one place and another, let there be three standard calorific values. I think that, generally speaking, it would be preferable to have three calorific values standardized and to maintain constant specific gravity and flame velocity in each place, rather than to put all the emphasis on the calorific value and to let the other factors go to glory.

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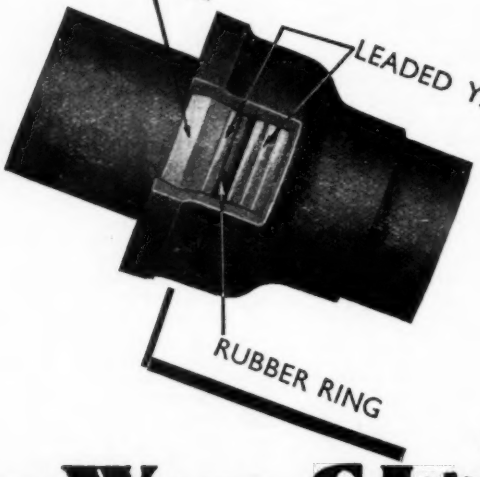

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Consumer Service

Communication No. 159

by
R. N. LeFEVRE
(Officer in Charge of Training, Gas Light and Coke Company)

Lieut.-Colonel W. FRENCH D.S.O., M.C. (Superintendent, Department of Technology, City and Guilds of London Institute): I was particularly glad to note that the service which the Department of Technology was able to render in connection with your schemes is satisfactory, though perhaps there is a snag to it in that it is all right in quality and quantity, but we do not seem to do it quickly enough. I was also interested to note that at one great training centre they are venturing upon specializing at the same time as generalizing; that is a feature that wants to be looked into vary carefully, and I think it is a trend of modern developments. Among many of the advisory committees of the City and Guilds of London Institute I see a shaking of heads when anything new is introduced, for there seems a desire to make the lad who is coming on do exactly the same as was probably done a good many years ago. Well, I hope your developments will be pursued.

It will interest you to know that in regard to numbers the examinations in Gas Fitting yield the second highest in the list of subjects in which we examine. This year there were roughly 2,200 examinees spread over the various grades, an increase of nearly 200 on last year. That raises the question of the provision of examiners. Thanks to the very great assistance which The Institution of Gas Engineers affords us, we have good teams of examiners at the various centres. But still, I think we have to look to the future, and if the numbers develop as they have been developing, we shall have to go into the nature of the practical examinations very carefully. That is a matter which no doubt will receive the consideration of your Education Committee by and by. I do not know whether the time has arrived for a comprehensive review of the various schemes and syllabuses, but somehow I think the matter requires consideration.

I wish to take this opportunity to express to The Institution of Gas Engineers and to all who act for us as local examiners our great appreciation of what they do. Without that help it would be quite impossible for the City and Guilds of London Institute to carry on the work in connection with the examinations in Gas Fitting.

Building Up Goodwill.

Mr. C. H. RENDELL (Gas Light and Coke Company): I think it will be agreed generally that consumer service is the main factor in building up that goodwill which must exist between consumer and undertaking if our business is to progress and prosper. Each of the components of that service—*i.e.*, design, construction, and testing of appliances and fittings, publicity and the proper selling of them, and, finally, their installation and maintenance—must advance in co-relation with each other; otherwise waste of effort or criticism of performance must inevitably arise. The immense progress made in the design of gas-consuming appliances in recent years, which we anticipate will continue, made us realize in the Gas Light and Coke Company that it was imperative to give systematic training to those whose work on the district brings them into contact with our consumers; otherwise the advantages gained by the progress in design and construction, manufacture and display, would be in danger of becoming depreciated or even nullified by bad selling, poor installation, or poor maintenance. We have carried on training for many years, but about seven years ago we re-planned and formulated the training scheme which we now have in full operation. In that time very much training has been given, but much remains still to be done so far as we are concerned before we can feel satisfied that the standard of knowledge and skill possessed by those upon whom the responsibility of satisfying the consumer rests is adequate for to-day's needs.

There is a world of difference, of course, between the newly trained man and the experienced man. The fact that a man has attended a course of training in any particular feature of his work does not make him an experienced man. Experience can be gained only as the result of doing the job over a very long period. Training does ensure, however, that a necessary degree of knowledge is imparted to the man in a systematic way, and that the cost, both in terms of money and of consumers' satisfaction, of the process of learning by mistakes is reduced considerably. It is for this reason, that the training courses at Watson House for new employees or for those who may be termed embryo district representatives, whether salesmen, fitters, foremen, or whatever they may be, are not only progressive but are designed also to qualify a man for employment on some particular class of work in which he can be gaining experience before he proceeds to take his next training course; and for the experienced man there is the refresher course system which keeps his knowledge up-to-date by bringing him into contact with the latest developments. We all realize that that is very essential, because at the rate at which we progress to-day it is very easy to get out-of-date in a very short time.

The effect of the training given at Watson House in recent years has been not only to increase very materially the general standard of knowledge possessed by those employed on the district, but also to enable us to handle the enormous increase of business that we have experienced in the last few years and to improve our standard of service at the same time. I venture to say that that would have been impossible without planned training of staff. In the early years of our training scheme we encountered many difficulties, not the least of which was criticism from those who had learned their job in the hard school of experience. There was also the reluctance on the part of trainees to "go to school," due, I think, to a suspicion of new methods of gaining knowledge of their craft. However, to-day all that has passed and men look forward to their training as a means of improving their knowledge and thereby leading to advancement in their work.

The Case for Training.

The case for training the gas fitter is put very aptly by the Author when he states that in the past the gas fitter had only to run pipes and connect to them what we should to-day regard as crude appliances, whereas nowadays pipe fitting is but a means to an end and the important factor is the perfect operation of the appliances. Many and many a sale has been ruined because the fitter has been a perfect pipe runner but has understood little or nothing of the apparatus, and has left the job in such a condition that the customer has been dissatisfied. The customer cares little or nothing about what happens prior to the apparatus, be it cooker, fire, instantaneous water heater, or anything else. The customer's concern is whether the appliance will do its job, and it is according to the measure of satisfaction given by the appliances that we are judged. So that until we are satisfied that each salesman, foreman, and fitter is able properly to play his part in reproducing in the consumers' premises the perfectly installed and perfectly operating appliances as seen by the consumers in the showroom, and as the result of which the order is placed, and until we are satisfied that our maintenance men are capable of keeping the appliances operating at the highest possible standard of efficiency, we should not be content with our service.

The gas fitters' classification scheme referred to in the Paper is playing a very important part in London in raising the general standard of craftsmanship of the gas fitters employed on the districts in those undertakings which have adopted the scheme, to the mutual satisfaction of both employees and employers. The employees benefit because they receive the rates of pay applicable to the grades of test which they pass, while the employers know that they are paying wages commensurate with the standard of knowledge and craftsmanship possessed by the men, and that that standard is uniform throughout the undertakings which have adopted the scheme. In London alone since the inauguration of the scheme well over 2,000 candidates have been examined in the various grades of test.

Finally, I would agree with Mr. LeFevre's criticism of the gas fitters' training course. It needs revising and bringing up to date so that it becomes self-sufficient as a medium for training the young entrants to the trade of gas fitter. The present gas fitting course is good, and it has done and continues to do good work, but it could be made much better and more useful if it were re-framed in the light of all the requirements of gas fitting practice on the district to-day.

Training in Birmingham.

Mr. W. L. S. SPINKS (Birmingham): I will refer to the training of the men, because I think that is the longest process, but it is the part of consumer service on which the smallest undertaking can do good work. The very smallness of an undertaking is sometimes a help, because you can build up a reputation for fair dealing and for good workmanship and can personally see that you keep it.

In Birmingham we had the first classes for gas fitters in 1899, and they have been continued since that date, though, of course, they have been extended and altered. And because someone in those early days realized the need for training the men we are now in the rather happy position of having between 400 and 500 fitters all of whom have passed through their apprenticeship with us, and we are able to recruit all our boys at the age of 14 or 15 years and pass them through our present scheme of training. That scheme of training does not by any means represent the last word that we hope to achieve, but there are one or two points about it that I should like to mention. We take the boys from elementary schools mainly. We have tried taking boys from the secondary school, but we have come to the conclusion that on the whole it is better to have the best boys from the elementary schools than the second-rate boys from the secondary school—you are rather apt to get the second-rate boys from secondary schools if you are not careful.

For the first two years of their work with us the boys attend a day continuation school on one day a week. Their training at that school is purely non-vocational, the purpose being merely to extend their ordinary education. During the winter sessions of those two years they attend classes in arithmetic and English at the Central Technical College. They do not start in the gas fitting course proper until after their sixteenth birthdays, and they go through an approved course. We provide tea for all the boys before they go to school; that does not cost much, but it means a lot to the students. We start our classes at 5.50 p.m., and the boys have finished by 8 p.m., so that they are not kept so late as ordinary students. It means that they have to leave work a little early, but it is a great advantage to them to finish their classes reasonably early, as it makes the thing less onerous. We try to make the classes interesting, and the Gas Committee gives prizes to the successful students in each of the various classes; we are fairly lavish with our prizes, so that quite a number of the boys can be successful and go on. In addition to the classes for the ordinary apprentices in the last year of their course, when they are about 20 years of age, we duplicate the classes and invite for a final year the fitters who have served their time. We have tried to mix them all together, but we find that the fitter of 25 or 30 years of age, who is really quite willing to go to classes with men of his own age, will not go to classes if he has to be mixed in with boys who have not finished their apprenticeship. But I am pleased to say that every year we get quite a good class for fitters up to 35 years of age, some of them perhaps being men who were not very keen on their training when they took it earlier, but have since seen the error of their ways and are now prepared to go to the classes.

Then, by negotiations with the shop stewards representing the men, we take them into our confidence and we draw up a series of lectures to fitters during the winter months. The subjects for these lectures are suggested by the men themselves, and we have really good attendances of all kinds of fitters. They attend the lectures in their own time. Then we have small demonstrations during the Department's time; those demonstrations are made to groups of 8 or 10 men at their own depôts. For instance, when the refrigerator was first boomed, we demonstrated it in that way, as has been the case with various water heaters as they were introduced. I think that is a very good way of getting hold of the interest of the men.

Recruiting Maintenance Men.

For some time now we have been able to recruit maintenance men from our cooker and stove repair shops. The men, having started with us as ordinary labourers, go through the cooker and stove repair shops and their names are recorded on a rota. From that rota we pick the men, according to their ability, who are to be engaged on the maintenance of apparatus on the district. One disadvantage of that scheme is that it entails a rather large labour turnover in the shops, but we do think it is the most satisfactory means we have found so far for recruiting our maintenance labour. A point I wish to stress is that the training of the men, although it has to be systematic, must also be continuous and must never finish.

We realize that there are many defects in our present system, but I bring it to your notice because you may like to know that in a smaller way a tremendous amount can be done, so long as you are willing to persist in it and to appreciate that you have to build on a broad basis. I do remember also that the intensive training of the manual worker has a great many drawbacks. The number of new facts which the manual worker will assimilate in any given time is small; we have found that from six demonstrations, spaced at intervals of a month, a man will learn more than he will learn from a course of six or ten days' continuous training. He is not accustomed to it, and it is better to teach him by means of a "series of events" than to ask him to alter his outlook for a fortnight. I am afraid he regards the latter in much the same way as we used to regard Army courses during the war, and he forgets a great deal.

I personally am a product of an early effort on the part of our Department in staff training. Some years before the war I was engaged in the commercial section. At that time two juniors from the showroom and myself were invited to go out as fitters' mates on the district for 12 months. Of course, that was a terrible shock to our natural snobbishness, but I have never regretted that 12 months' hard labour, for it has been most useful to me; and I hope the Department did not regret its investment. I do believe that if everyone concerned would make an effort in the training of the men it would be an excellent thing.

Behaviour of the Fitter.

Dr. J. N. LONG (Principal of the Westminster Technical Institute): There are only two items which the author might have missed. One is the attitude and behaviour of the fitter when, in a lady's drawing-room, he has with him two small sons of the lady, their ages being, say, 2 and 7 years respectively, helping to unpack the tools and do the job. The second is that of the attitude and proper deportment of the fitter when the lady sends to him at 4 o'clock a dainty cup of tea, two biscuits, and a cigarette. These notions of mine are not quite so stupid as they might appear at first sight, because, however good your salesman—he is probably smart, his hair is cut and his nails manicured, he carries a smart leather case, wears yellow gloves and brings off the sale—the man who comes to do the installation work is the fitter, and I venture to say that the whole of the salesman's work can be readily undone if the fitter has not a proper regard for the Wilton carpet in the drawing-room or an Indian carpet in one of the bedrooms. The whole attitude of the housewife towards gas rests, not with your smart salesman, but with the fitter who is doing the job; unless the fitter does his work well and has a proper regard for the furnishings and the young children who are there bothering him, and the lady who wants the latest information about one item and another, the salesman will find extreme difficulty when he visits the house subsequently.

The Gas Light and Coke Company has for 28 years co-operated with the London County Council in the training scheme. I think the Company is entirely right in giving practical training in the works and in providing for training in technical drawing, science, English, civics, and the like at a technical institute. We think that in an institute outside the atmosphere of the works we can teach these things better than the Company could possibly teach them within the Works. Thus, the Company, in taking an apprentice into its scheme, is doing something more than merely making him a skilled workman; it is making him a good citizen as well, and there is no reason at all why the gas fitter apprentice should not be a thoroughly good workman and a good servant of the Company and a thoroughly good citizen too. We have heard from Birmingham that the best students come from the elementary schools, at the age of 14 years. If it is the practice to take such boys, that is all the more reason why we in the technical institutes should give them some little culture and arouse their interest in life, in municipal government and in many other things, which interest cannot be given to them whilst they are being trained in the practical aspects of fitting.

Personally I am obliged to the Company for a rather interesting concession made some years ago. I told Mr. Lacey that I thought that while the boys were trying to learn arithmetic, science, drawing, and such subjects, which entailed rather intensive study, it would be a good thing if the length of their day at my Institute were reduced to from 9 to 5. That has proved to be a very nice concession. The London County Council cannot provide tea at 4 o'clock; but by giving the boys an hour's physical training a day in a well-equipped gymnasium, under a competent instructor, and by giving them also a knowledge of physics and English and of the town and the country in which they live, we hope to make them

better able to receive their practical training next morning at Watson House.

There is great difficulty in securing good teachers. If there is one thing in the world which a person thinks he can do, it is teach. Mr. LeFevre and I have found it necessary to train teachers gradually, and at Westminster we are applying mostly now the services of past trainees of the Gas Light and Coke Company. There are distinct advantages in that, and on the whole, if our scheme is worth anything, the training given should make good teachers in the majority of cases by the time the men reach years of discretion.

Finally, may I plead that all representatives of local gas undertakings here should see their local Directors of Education and Principals of local technical colleges in connection with their scheme. The education authority is waiting to help you with the schemes. They will provide accommodation, they will provide teachers and pay them and will get out schemes for you. If you are contemplating a scheme—and I think Mr. LeFevre's Paper should set your minds thinking along such lines—go to the local authorities, for they can help you in very many ways, and I think it is safe to say that they will be able to help you to run a scheme in co-operation very much more cheaply and more efficiently than you could run it yourselves.

The Spearhead of Service.

Mr. C. N. CRITCHLEY (Gas Light and Coke Company): I should like to elaborate the aspects of what might be described as the spearhead of service, the contacts of service personnel with consumers. In the section of the Paper dealing with service personnel, the Author states: "It will not be denied that possibly the most important man in any service organization is the foreman." With that statement I find myself in disagreement. The importance of competent foremen in ensuring what might be termed first-class *static* service to the consumer cannot be over-emphasized; but *progressive* service must be achieved by personnel of a higher degree of technical competence than can reasonably be expected in foremen. There is a brief description of the duties of a Service Supervisor; it is stated that "The Service Supervisor's duties, in brief, are to get the work done efficiently and to keep down costs and reduce wastage," all suggestive of a type of glorified foreman. As I view the functions of a Service Supervisor, one of his principal duties should be the appreciation and correlation of district problems (those technical details which at present militate against the ideal of perfect service to the consumer), bringing them to the attention of the research personnel and, in the course of time, the practical application of such solutions to those problems as the research personnel are able to evolve. With that aim in mind, the Service Supervisor on the staff of the Gas Light and Coke Company has been recruited not only from men whose experience has been gained solely on the practical side, but also from the ranks of trained investigators, men whose undergraduate and post-graduate training was essentially on the principles of investigation and which was augmented subsequently by sound practical experience. It may sound an easy matter for a Company having 5,000 fitters in daily contact with the consumers—to take only one category of employee—to collect information and bring it back to the research personnel in such a way as to ensure the correct perspective. But actually it is very difficult, and it is one of the primary duties of the Service Supervisors, as a task which can be performed only by a man with a high degree of technical competence and training.

In reaching his conclusions, Mr. LeFevre asks four questions—(1) What does complete customer service cost? (2) Does it pay—*i.e.*, is it worth the trouble? (3) Can too much service be given? (4) What is the ideal system? Then he proceeds to answer those questions. For example, in answering the third question, he sums up by saying, "Service must be fair to customers; it must be good; it must be reliable; but it must be on a sound economical basis and kept within its proper sphere." From the point of view of background training that may be an answer to the question. But from the wider point of view it does not constitute an answer at all, because one is left with the question, What is a sound economical basis and what is the proper sphere?

Giving Too Much.

I am personally of the opinion that in certain aspects of service we have given too much. For example, in my own Company it is the practice to maintain cookers once a year. I am convinced that that is too much, at least during the early life of a cooker; it is quite needless then. The necessity for maintenance service may increase with the age of the appliance, and in point of fact the necessity for maintenance service as the age of the appliance increases may determine, at least in the case of hired appliances, the optimum maintenance and exchange policy. We are carrying out a thorough investigation into the optimum maintenance periods.

While I should be one of the last to depreciate the important part which shop and class training can play in supplementing practical experience, it should be emphasized that probably the most important part of a craftsman's training is obtained in the hard practical school. Some of the best craftsmen I have ever encountered have been men who have had no facilities whatever for either class or shop training, but who have acquired their high degree of skill by keen application to the practical aspects of their craft. Pride of craft is the first essential, and if that and solid practical experience are absent, no amount of so-called training will produce the type of operative required. Mr. LeFevre mentioned the type of man "who boasts that he can do anything with a pair of two-hole pliers or a mashie-niblick." In my very limited experience I have never seen a golf shot played as though by a pair of two-hole pliers. But it has been my unfortunate experience to see fitting work which looked as though it were carried out with a mashie-niblick—the mashie-niblick having been applied with rather grotesque effect.

Openings for Secondary Schoolboys.

Dr. BURNESS (Board of Education): A speaker has mentioned that the best elementary school boy is better than the second-rate boy from a secondary school, and that, of course, is perfectly true. Unfortunately, a great deal of the criticism of secondary schools and their products by industrialists is due to the very fact that industry has not yet persuaded the educational authorities, if you like, and particularly the headmasters and staffs of secondary schools, and more particularly still the parents of secondary school pupils, that there are openings in occupations such as gas fitting for the boy who does not object to working with his hands and being engaged in a really interesting occupation, and ultimately or at quite an early date securing a responsible and perhaps still more interesting position. We have to face the fact that the reorganization in education has meant that in general there are not in the elementary schools to-day the same type of boy that we were able to get 20 years ago, because he is hauled out of the elementary school at the age of 11 and is put into a secondary school; therefore, he is rather tempted to look towards the so-called black-coated professions, and in consequence industry is feeling the lack of the really good elementary schoolboys who want to go into a manual occupation and make good later.

Mr. LeFevre has criticized to some extent the City and Guilds and The Institution of Gas Engineers' scheme of training for gas fitters on the ground that it is too general, and he calls for more specialization. That is, of course, a criticism of The Institution of Gas Engineers' Education Committee, and they, of all people, would be the first to be prepared to go into that scheme and to see what could be done about it. I am quite sure that is so. But I would utter a word of caution. Mr. LeFevre has been speaking from experience in the Gas Light and Coke Company, the largest undertaking in the country and possibly in the world. Its staff assumes enormous proportions and its area is relatively compact, which means that employees of all grades can be transported from one job to another comparatively easily. Specialization is obviously the policy to pursue in those circumstances. But what is sauce for the gander in this case may not be sauce for all the other geese throughout the country—perhaps I should not refer to the Gas Light and Coke Company as a gander, because I expect it has laid quite a few golden eggs by now. However, we want to bear in mind that conditions in other undertakings in various parts of the country are entirely different, and, therefore, I feel that in general the broader type of training dealing with the majority of appliances that the fitter is likely to come across in his job is preferable to specialization for relatively short periods on particular types of apparatus during the apprenticeship days.

I think the trainee should have the broader training first on all appliances up to a point, and should specialize later. Another point which is mentioned in the Paper—and I think certain undertakings are finding it advantageous—is to start the gas fitters in the shops for some time, if manufacture is carried out, or certainly in the repair shops. That is much the better way of training them in the correct use of tools; you can give them that experience in the shops, where you can have qualified instructors and can give the trainees far greater attention than they will get while they are acting as mates to fitters on the district. I

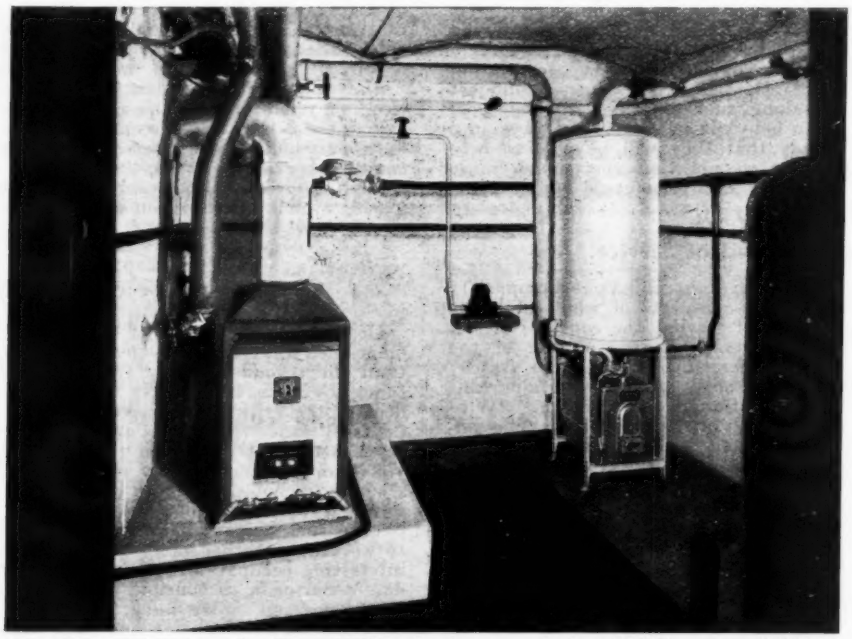
THE REASON

POTTERTON'S "Gas-Fired" Water Heaters ensure complete combustion of the fuel with fully-automatic effect. They are silent in action, essentially clean, and have no mechanical parts.

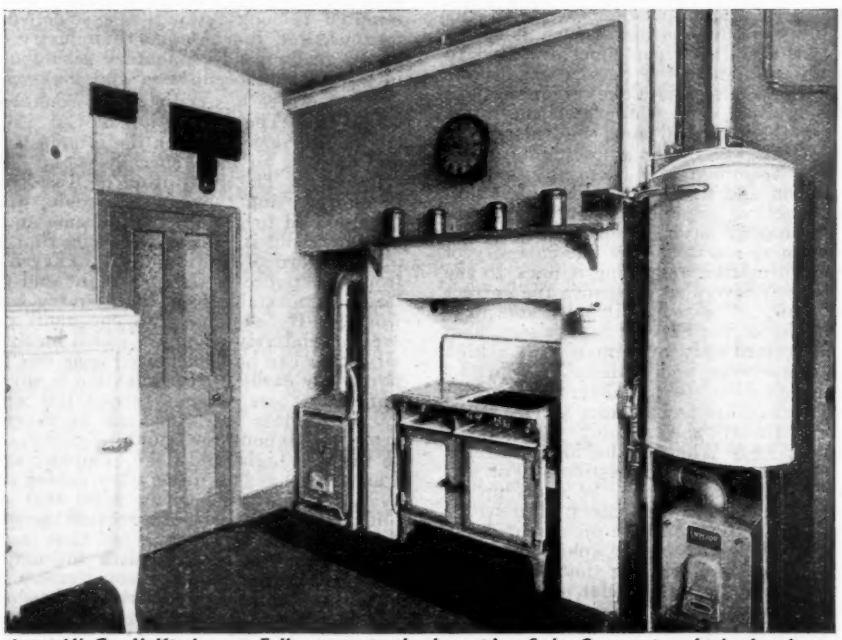
Freedom from condensation within the flueways, maintaining continuity of efficiency with low maintenance cost, is a special feature of merit which has placed these Heaters in the forefront of Boiler Equipment in the Gas Industry.

Hence they can be used with confidence for all domestic and trade purposes.

The illustrations here shown depict two examples of modern treatment in Central Heating and Hot Water Supply.



The heating chamber of a Town Hall in London in which "REX" and "EMPIRE" Boilers have been installed to replace steam-heated calorifiers.



An "All-Gas" Kitchen at Folkestone, justly the pride of the Owner, in which cleanliness is supreme; the enamelled surfaces of the "REX" and "EMPEROR" Boilers, the Refrigerator, and Cooker, assist in this achievement.

THOMAS POTTERTON (Heating Engineers), LTD.

RAVENSWOOD ROAD, BALHAM, LONDON, S.W. 12.

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think that perhaps more of that in underakings throughout the country would improve the training of the gas fitters.

A Great Change.

Mr. Dean Chandler (South Metropolitan Gas Company): So far as my own Company is concerned, many years ago we instituted a training school for training young men in practical gas fitting. It was certainly not on the ambitious scale that applies to Watson House to-day, but I can tell you that we have found our own training school extremely useful to us, and all I can say is that if the Gas Industry in the future follows the lead set by the Gas Light and Coke Company, it augurs well for the Industry. As a matter of fact, there is a great change coming over the Industry, and I am very glad to see it, because I thought at one time that the evening of my days would be troublesome and burdensome, whereas in view of the activities of to-day I begin to feel that there will be some chance of my getting my pension!

Mr. LeFevre: I should like to thank all who have contributed to the discussion. So many points have been raised that my reply is likely to be almost as long as my Paper. Therefore, I will reply in writing.

Third International Gas Conference

Paris, June 12 to 16

The principal items of the business sessions are as follows:

Saturday, 12th June, 1937.

Opening of the 3rd International Gas Conference at the Société des Anciens Elèves des Ecoles Nationales d'Arts et Métiers, 9*bis*, Avenue d'Iéna, Paris 16e.

Monday, 14th June, 1937.

Report of Committee on "Co-ordination of Methods of Testing and Guaranteeing Gas Making Plants."

Paper on "New Processes for Recovering Benzole and their Economic Study," by Professor Dr. K. Bunte.

Paper on "Evolution of Gas Making Processes in France during the last Twenty Years," by Mr. A. Bazille.

Tuesday, 15th June, 1937.

Paper on "Experimental Determinations and Computation of Combustion Temperatures. Application to the particular case of Town Gas," by Mr. G. Ribaud.

Paper on "Uses of Petrol Gas in Industry," by Mr. I. Wielizynski.

Paper on "Formation of Nitrogen Compounds, Compounds Contained in Gas and the Formation of Nitrogen Oxides in Flames," by Mr. P. Schlaepfer.

Report of Committee on "Systems of Carcassing Buildings."

Wednesday, 16th June, 1937.

Paper on "Technical Service for Gas Consumers," by Mr. R. N. LeFevre (London).

Paper on "Electrolytic Corrosion of Gas Mains," by Mr. H. C. Widlake (Plymouth).

Paper on "Materials Used for Gas Mains," by Professor M. Levi.

Report of Committee on "Co-ordination of Methods of Testing Gas Appliances."

Report of Belgian Gas Association on "Methods for the Development of the Industrial Use of Gas, including the Hotel Industry."

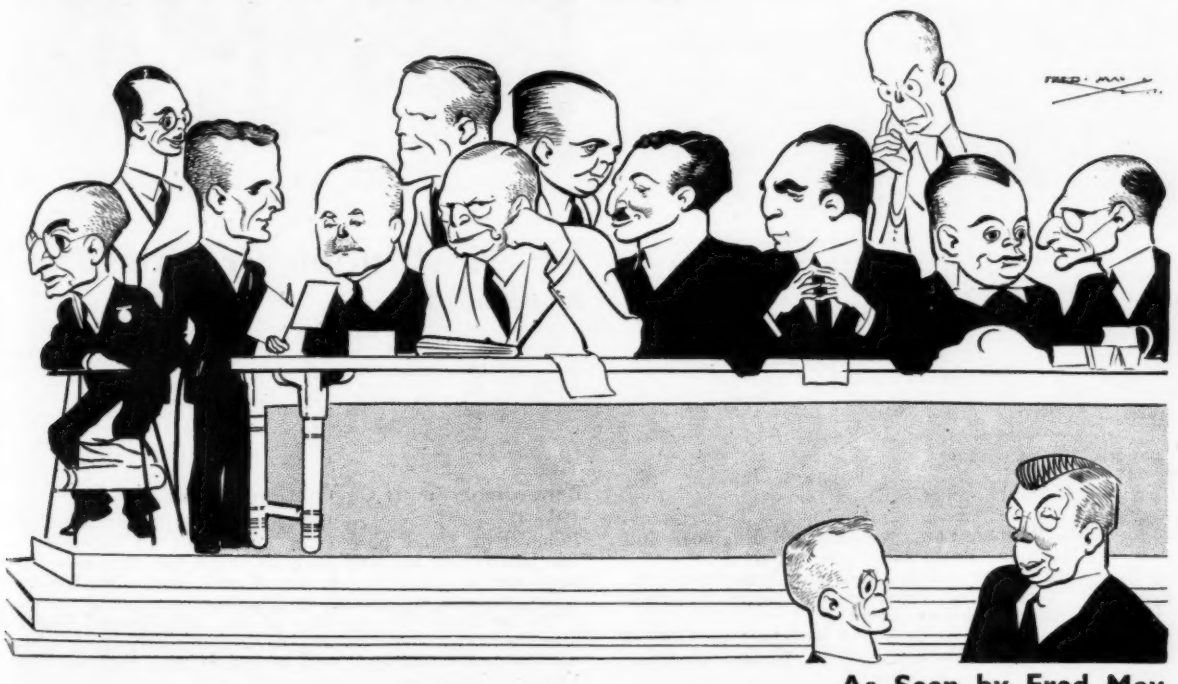
Report of Committee on "Principles of Gas Tariffs."

Paper on "New Bases and Forms of Tariffs in Germany," by Dr. Hoffmann.

We are indebted to the Secretary for the following list of those who will comprise The Institution delegation:

Mr. J. R. W. Alexander, M.A., LL.B.
Sir Albert Ball, J.P.
Lady Ball
Sir Russell Bencraft, J.P.
Mr. F. Hayter
Mr. H. E. Bennet, M.C.
Mr. C. Valon Bennett
Mr. H. E. Bloor
Dr. W. T. K. Braunholtz, M.A.
Mr. F. C. Briggs
Mr. C. F. Broadhead
Miss P. Broadhead
Mr. J. W. Brown
Mr. Bernard F. Browne
Col. W. Moncrieff Carr, O.B.E., T.D.
Mrs. Carr
Mr. and Mrs. R. P. Chester
Mr. W. N. Gilbert Harris
Dr. F. J. Dent
Mr. and Mrs. George Dixon
Councillor William Duncan
Mr S. W. B. Flavel
Mr. and Mrs. Edward J. Fottrell
Dr. Bernard Friedman
Col. W. R. Glover, C.M.G., D.S.O., T.D.
Mrs. Glover
Mr. Ernest Hardiker
Mr. and Mrs. H. Hollings
Mr. and Mrs. R. W. Hunter
Mr. James Jamieson
Mr. and Mrs. Clifford A. King
Mr. and Mrs. Stephen Lacey
Mr. R. N. LeFevre
Mr. and Mrs. C. A. Masterman
Mr. and Mrs. George P. Mitchell
Councillor Walter Muter
Mr. and Mrs. B. R. Parkinson
Col. O. B. F. Planck, D.S.O., T.D., D L.
Mr. and Mrs. F. B. Richards
Mr. W. D. Rowe, M.C.
Mrs. Rowe
Mr. and Mrs. A. H. Silcox
Mr. and Mrs. H. C. Smith
Mr. H. Stanley Taylor
Mr. and Mrs. S. E. Whitehead
Mr. H. C. Widlake

"The Platform" at the Meeting



As Seen by Fred May

New Members of the Institution

During the Meeting the following were elected to membership:

To Honorary Membership.

The President (*ex-officio*) of the International Gas Union and the Presidents (*ex-officio*) of the Gas Associations of Australia, Austria, Belgium, Canada, Czechoslovakia, Denmark, France, Germany, Holland, Hungary, Italy, Japan, New Zealand, Norway, Poland, Spain, Sweden, Switzerland, United States of America, and Yugoslavia.

To Membership.

Chandler, Dean, Senior Technical Officer, South Metropolitan Gas Company.
Dickson, David Lawson, Engineer and Manager, Newport Gas Department, Fife.
Fletcher, William, Superintendent, Garston Station, Liverpool Gas Company.
Walter, Cecil Montague, D.Sc., Engineer-in-Charge, Industrial Research Laboratories, Birmingham Gas Department.
Ward, Denis John, Assistant Engineer, Swan Village Station, Birmingham Gas Department.

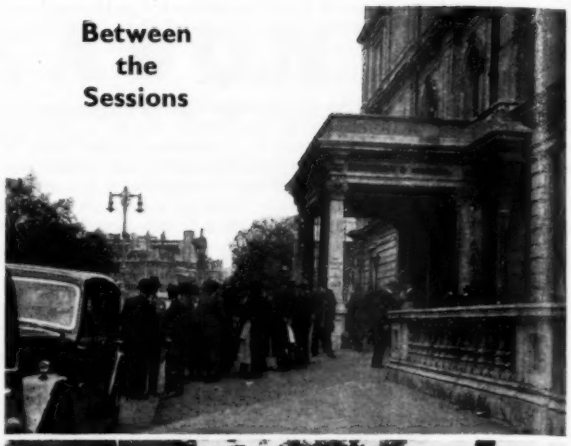
To Associate Membership.

Burkhill, George Edgar, Assistant to Gas Manager, London, Midland and Scottish Railway Company, Crewe.
Corrin, Charles Richard, Works Chemist, Douglas Gas Light Company.
Gorman, Eric Frederic, Technical Assistant, East Greenwich Station, South Metropolitan Gas Company.
Langford, Kenneth Henry Howard, Engineer's Assistant, Grangetown Station, Cardiff Gas Light and Coke Company.
Livingstone, Thomas Blackwood, Second Engineering Assistant and Chemist, Alloa Gas Department.
Marriage, Edward Bruce Russell, Chemist, Severn Valley Gas Corporation, Ltd., Cheltenham.
Shilson, Arthur Charles, Senior Draughtsman, Weston-super-Mare and District Gas Company.
Storey, William, Works Superintendent, Barnet District Gas and Water Company.
Sumner, Philip, Assistant Engineer and Manager, Altrincham Gas Company.
Sutcliffe, William, B.Sc., Technical Assistant, North Shields Station, Newcastle-upon-Tyne and Gateshead Gas Company.
Tate, William Kenneth, M.A., Engineer and Manager, Sheppy Gas Company.
Thomas, Arthur Leonard, Industrial and Distribution Assistant, Neath Gas Department.
Wardle, Bernard William, Technical Assistant and Chemist, Basford Station, Nottingham Gas Department.
White, Walter Harold, Draughtsman and Clerk of Works, Nine Elms Station, The Gas Light and Coke Company.
Woodcock, James Arthur, Carbonizing Superintendent and Clerk of Works, West's Gas Improvement Company, Ltd., Manchester.

To Associateship.

Alexander, John Russell Willis, M.A., LL.B., Secretary, The Institution of Gas Engineers.
Andrews, Thomas William, Technical Assistant, South Metropolitan Gas Company.
Black, Edwin Walter, Special Representative, The Gas Light and Coke Company.
Boon, Wilfred Leonard, General Manager, The London and Counties Coke Association.
Brookes, John Thorpe, Assistant to District Superintendent, British Gas Light Company, Norwich.
Denton, John William, Assistant Engineer, Torquay and Paignton Gas Company.
Dougherty, Cyril James, Acting Assistant Manager, New Wortley Station, Leeds Gas Department.
Fulton, John Harper, Chemist, Glasgow Gas Department.
Holroyd, John Walter, Chief Assistant to Engineer and General Manager, Rotherham Gas Department.
Mitchell, James Millar Allan, Assistant Superintendent, Domestic Gas Sales Department, Newcastle-upon-Tyne and Gateshead Gas Company.
St. Leger, Arthur Antony, Technical Assistant to Chief of Sales Department, Watford and St. Albans Gas Company.

Between the Sessions



Institution Brevities

An Index of Progress.

An excellent index of the progress of the Institution is provided by the following acceptances for the June Meeting and the reception and dance during the past three years:

Year.	Attending Meeting.	Reception and Dance
1935	1,289	990
1936	1,362	1,005
1937	1,632	1,243

Benevolent Fund: Coronation Appeal.

On the eve of the Coronation, the Hon. Secretary of the Benevolent Fund posted an appeal to all members of the Institution inviting each to mark the Coronation by becoming a subscriber to the Fund, increasing his subscription, and/or making a donation.

The result at the opening of the 74th Annual General Meeting was the receipt of contributions exceeding a total of £155, of which 15% will be recurring. Further donations are invited.

Less Formal Moments

OF THE

Institution Meeting

Social Events and Visits

THE RECEPTION AND DANCE AT GROSVENOR HOUSE

The reception and dance was held on the Tuesday evening, and, as last year, in the Great Room of Grosvenor House, Park Lane, W. 1. Although attended by a record number of guests, it is gratifying to note that there still remained a generous margin of comfort; certainly it occasioned no inconvenience to move among one's friends or *tour-de-force* to take the floor. It was in fact hard to believe that the number of those present totalled for the first time on record over a thousand persons.

The guests were received by the President and Mrs. Lacey, who were supported by Colonel W. M. Carr, O.B.E., T.D., in the same charming manner as last year when they deputized in the regrettable absence of Col. and Mrs. Carr.

By time-honoured custom the District Association of which the Institution President is a member has the honour of presenting a bouquet to the President's wife. This year the pleasant duty fell to Mrs. S. E. Whitehead, whose husband is the President of the Southern Association, of presenting a bouquet of yellow cream roses.

To the rhythmic strains of Jack Palmer and his Band, dancing continued from 9 p.m. to 2 a.m.

COUNCIL LUNCHEON TO THE PRESIDENT

The customary Council Luncheon to the President took place on the Thursday at Gas Industry House, the Chair being taken by Mr. H. C. Smith, M.Inst.C.E., President-Elect. The toast of "The President" was proposed by Colonel W. M. Carr, O.B.E., T.D., and "The President-Elect" by Mr. Henry Woodall, J.P., M.Inst.C.E. "The Hon. Secretary and Secretary" was given on the call of the President.

Those present, in addition to the above, included: Sir David Milne-Watson, D.L., LL.D., Sir Frederick West, Messrs. J. R. W. Alexander, M.A., LL.B., F.C.I.S., W. W. Atley, C. Valon Bennett, W. H. Bennett, W. T. K. Braunholtz, F. C. Briggs, H. Burton, T. Carmichael, R. J. H. Clark, D. Cleave Cross, George Dixon, Lieut.-Col. G. S. Eunson, Messrs. Walter Grogono, A. L. Holton, R. W. Hunter, A. S. Nisbet, R. Robertson, F. P. Tarratt, John Terrace, W. W. Townsend, J. Wesley Whimster.

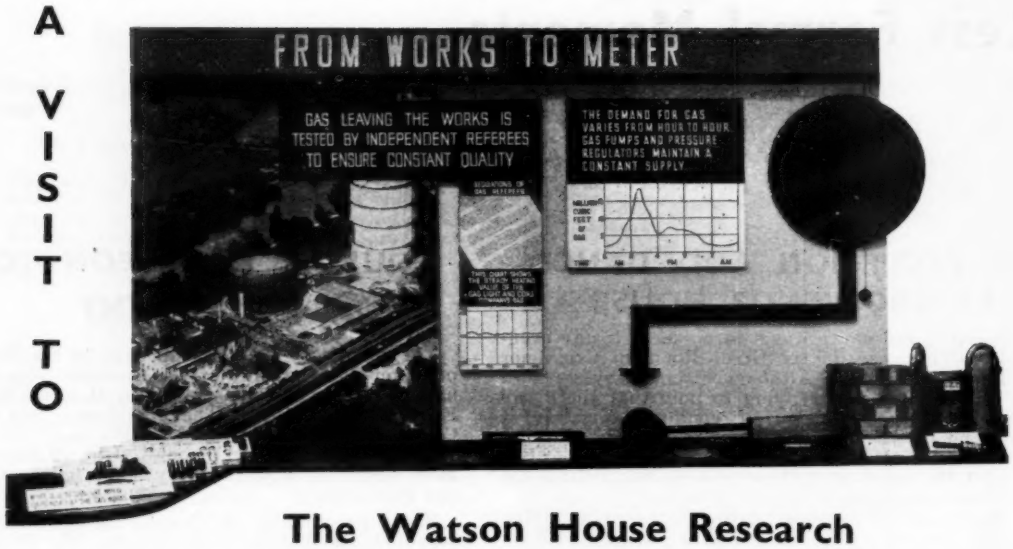
Messrs. B. Clarke, James Jamieson, A. Law, and Octavius Thomas were unable to attend.

AN AFTERNOON AT THE

National Maritime Museum

On Wednesday afternoon an Institution party of about 130, among whom was Mrs. Lacey, visited the National Maritime Museum at Greenwich, which was opened in April last by H.M. the King. The historic buildings house a unique collection of naval canvasses and nautical instruments, but probably the most impressive is the section devoted to relics and records of Lord Nelson. After tea, which was served on the lawn, Col. W. Carmichael Peebles expressed thanks to the Authorities and to Capt. Maxwell for the arrangements made to entertain the visitors.

A VISIT TO


FROM WORKS TO METER
GAS LEAVING THE WORKS IS TESTED BY INDEPENDENT REFEREES TO ENSURE CONSTANT QUALITY
THE DEMAND FOR GAS VARIES FROM HOUR TO HOUR. GAS PUMPS AND PRESSURE REGULATORS MAINTAIN A CONSTANT SUPPLY

The Watson House Research and Training Centre

The new Watson House Buildings, covering 4¼ acres, were opened on Dec. 3, 1936, by Lord Snell, and were fully described in the "JOURNAL" for Dec. 9 (p. 732).

The great popularity of Watson House with the layman as distinct from those connected with our Industry has rendered essential a new feature recently completed. When one learns that since it was opened over eight thousand visitors have availed themselves of the Company's invitations to see at first hand the vast and thorough organization of unremitting research that has rendered so truthful the two great slogans of the Company, the proud claim "The Gas Light and Coke Company Never Lets London Down" and the inviting "Mr. Therm Burns to Serve You," the reason for this new feature will be at once apparent. This total of eight thousand represents roughly sixty visitors a day, and, when all is said and done, much as the Company welcome their guests—and their hospitality was much in evidence on this occasion of the Institution visit—sight must not be lost of the true *raison-d'être* of Watson House. The Company have, therefore, centralized all their demonstrations, which formerly stood in the laboratories, together with many other features of interest to the visitor in one large Reception Room adjoining the entrance.

Here, instead of tarrying during a tour of the laboratories, the visitor may at leisure examine anything of particular interest without upsetting any tour of the building or disturbing those engaged on the work of research. A tour of the building itself is, therefore, expedited without the visitor missing anything of interest.

In going round this new feature our thoughts naturally turned to the Science Museum at South Kensington, some of whose popularity it bids fair to capture. The many fascinating working exhibits, with a goodly sprinkling of "press-the-button-and-it-works" demonstrations which never fail to attract, have been arranged in a logical sequence. Everything is spick-and-span and the pervading atmosphere light and airy, enhanced by that delightfully fresh colour scheme which is a feature of Watson House. In a word, it is "cheerful."

On entering the visitor is greeted by a very large cartoon depicting in light vein the various activities of Watson House and those connected with it. This highly entertaining feature, together with the traditional hospitality of the Company, must surely completely banish any "bureaucratic" notions on the part of the guest. It is as it were an *aperitif* to what follows, course by course, to complete a veritable feast of interesting exhibits. Each side of the entrance are what one might be pardoned for calling Industry prestige statistics in pictorial form; the description, however, hardly does justice to them. By their bold figures and significantly proportioned diagrams they illustrate such features as the growth of the Industry, increased sales of gas and coke and the consequent diminution of soot deposited as the results of burning raw coal, and so on.

The exhibits are arranged around the room on the three remaining walls and on one side of a centre partition. The Company have broken away from the usual "gas-works model" type of exhibit, and after a display of coal and by-products received from the manufacture of gas explained in simple language, one passes on to methods of laying services from the main to the consumer's meter. There are shown various types of meter, one of which is cut-away so as to permit of an inspection of the interior, and a comparison is made of the old cumbersome "lights" model and the new small high-capacity type. The prepayment mechanism is also demonstrated. Passing from meters to governors, here again we find use has been made of the cut-away section to show the method of operation. An exhibit shows how a governor prevents fluctuating gas pressures at the burner.

The Governor Joins the Visitors on the Tour of Inspection.

An oblong solid divided into different coloured zones shows the constituents of coal gas and the proportions of oxygen and nitrogen in the air required for combustion. A

similar model shows the proportions of the products of combustion. Two tiny cubes affixed to the top of this solid show the very small proportion constituted by the oxides of nitrogen and sulphur. Coming to the burner itself, the characteristics of bunsen and luminous flames are shown, involving a visual comparison of the two. Flames burning in glass flues provide a means of demonstrating the effect of restricting in the first place the air required for combustion and secondly the effect of preventing a free exit for the products of combustion.

expansion of one of the metals in excess of the other is shown by an indicator moving over a scale, when the two metals are heated together. There is also shown an oven thermostat in section. These sections are a lesson in craftsmanship, and particularly fine is a sectional cut-away of the Parkinson " Renown " cooker, to show the intricacies of the interior construction which are not apparent from the outside. Another feature of more than passing interest was the Gas Light and Coke Company's cooker with fixed injectors and governor. On this model is fixed ap-

Interested Members View the Exhibits at Watson House.

The Cooker.

The next section deals with the cooker. A number of specimens which had been on test for about two years show that for grill frets heat resisting steel will stand up better than other materials, and another exhibit shows how much more quickly the new type of grill heats up compared with the old. A most interesting feature is a demonstration of the working of the bi-metallic thermostat. The

paratus for testing the products of combustion showing the efficiency of the burners. The cooker is made of stamped steel, and to date over 350,000 have been sold.

Of particular interest to the housewife is the home service section, where common faults in baking are related to their causes. There are also tests for the efficiency of the boiling ring and for the enamel work of the cooker. The measurement of comfort conditions by such apparatus as the eupatheoscope is demonstrated in the fire section,

In the foreground (L. to R.): Messrs. R. N. LeFevre, F. C. Smith, C. A. Masterman, and W. Dieterichs, who, with the whole of the Watson House Staff, contributed so largely to the success of the visit.

where there is shown a representative range of the latest models. Here also are some overhead bowl radiant heaters. The application of the measurement of heat as for light distribution is demonstrated by a sinusoidal diagram, illuminated from behind, with an outline of the room superimposed thereon. The automatic lighting of gas fires by various means is shown together with an exhibit showing the evolution of the modern fire radiant and back-brick, with the consequent increase in heat obtained.

In a section devoted to gas-fired boilers is shown how the wall thermostat operates. The visitor may operate this model for himself as many of the others. Central heating units with room temperature control, clock operated "night and day" thermostats, and pictures of typical installations of "Ideal" and "Potterton" boilers complete this section. The next part of the exhibit is devoted to water heaters. Here again a model which may be operated by the visitor shows the effect of position on the operation of a ventile. The photometric section provides many treats; one may gaze through a little window and vary the characteristics of a street lighting installation. Here too are shown a floodlighting unit similar to the type used in St. James's Park during the Coronation, the manufacture of the gas mantle, and the method of plotting light distribution. In the refrigeration section the operation of the unit is shown by sections. A striking feature is Mr. Therm with a body of frost and flames playing behind the fins of his head, a striking demonstration of the "flame that freezes." There follow various examples of the work Watson House has carried out on the industrial side, including muffle furnaces for assaying work, samples of refractories, and a section of a small muffle furnace.

Down the centre of the room on one side of a partition are various exhibits showing that "testing more than pays for itself." Here are arrayed examples of pipes and joints apparently sound, but on further inspection revealing dangerous defects. One is shown how, and how not, to fix a meter, the type of examination the trainee has to pass, and examples of the apprentices' work.

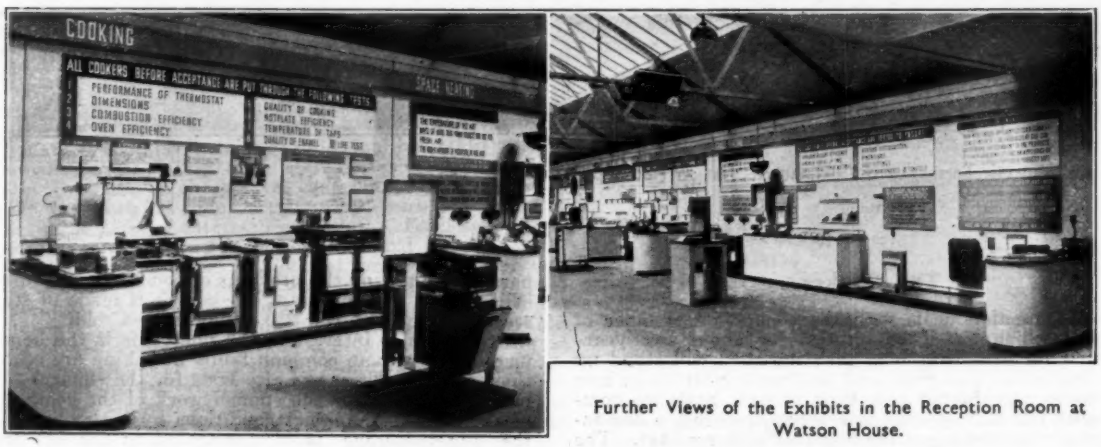
The Laboratories are responsible for research, development, and testing, covering all the various problems connected with the use of gas. Contact is maintained with research centres in this country and overseas; with appliance manufacturers and suppliers of all sorts and kinds of materials.

Five Development Laboratories are maintained, specializing respectively in Water Heating, Space Heating, Cooking, Industrial, and Lighting.

Testing.—In addition to ensuring that any new type of appliance, fitting, or material is suitable, it is equally necessary to ensure that all deliveries are maintained up to the original standard. For this work the Testing Section is responsible, having its headquarters at Watson House, the routine testing being carried out on the goods at makers' works or as delivered at the Stores Depôts.

Industrial.—The Industrial Section operates in the closest collaboration with the various specialized makers of industrial apparatus to ensure, as far as possible, that this apparatus is operated by gas. The Industrial Showroom at Watson House is of considerable use to these manufacturers in enabling them to meet their customers and show them gas equipment suitable for their purposes.

Training.—The training of the Company's sales and service personnel is carried out at Watson House in order that this training may as closely as possible be influenced by the latest information obtained by the Laboratories. At any one time about 300 men and boys are in training, the courses mostly lasting for one week or half a week only. Every effort is made to ensure that each fitter receives a Refresher Course once a year, subsequent to passing through the graduated series of courses which convert an inexperienced boy or man into a fully qualified fitter.



Further Views of the Exhibits in the Reception Room at Watson House.

Guests of the President's Company

The Institution were the guests of the President's Company, the Gas Light and Coke Company, at Fulham on Wednesday and Thursday.

Assembling at Gas Industry House on both occasions, the members were conveyed by motor coach to Fulham where they inspected the Gas-Works, gas manufacture research laboratories, gas distribution and utilization laboratories, and the stove and meter shops. During the afternoon the guests were entertained at tea in the Dining Hall of Watson House by kind invitation of the Company.

Tea over on the first day, Mr. LACEY said he was sure they would expect him as President to thank the Company for their hospitality. He was filling a double part. As President he did thank the Company on behalf of the Institution for the admirable way in which the visit had been arranged, while as an Officer of the Company he would like to thank his staff and colleagues at Watson House for their help. They were very fortunate in having with them that day Mr. Foot, who as they all knew was a very busy man. He asked them to express to the Company their appreciation of the facilities granted them during the visit. This proposition was carried with acclamation.

In reply, Mr. R. W. FOOT, O.B.E., M.C., General Manager of the Gas Light and Coke Company, said it had been a week of speechmaking and he did not know how many words had been spoken since the Meeting opened; but he proposed to say only two things. First, he would like to thank them very much for the cordial way in which they had received Mr. Lacey's kind words and to say how delighted the Company were to receive so many very distinguished visitors from the Gas Industry. Secondly, he wished to say how proud the Gas Light and Coke Company were to have provided the Institution with this year's President. In addition they were highly gratified that President had been found in the person of Mr. Lacey, who had occupied the position with traditional dignity and had been a worthy successor to all who had held the office.

THE FULHAM WORKS

These works, the second largest in the Company, were originally constructed in 1829, and are now probably the oldest gas-works in London. None the less they are representative of many of the most up-to-date features of gas-works construction. The Fulham Station, as it is called, has a gas-making capacity of 135,000 therms, or 27 million cu.ft. of 500 B.Th.U. gas, a day and occupies a site of 30 acres. Access for materials is afforded by a wharf on the river bank, an enclosed barge dock reached from the river by a short creek, railway sidings connected with the West London Extension Railway and by the King's Road, within a few yards of the gate.

In order to save handling charges, coal, of which the Station now treats 1,580 tons a day when in full operation, is brought direct from northern coalfields by certain of the Company's colliers (of 1,750 tons capacity), specially designed for this up-river work. To deal with these a riverside wharf was constructed where two cranes (with one additional stand-by crane) with 5-ton grabs unload the vessels in 6¼ hours into a reinforced concrete bunker holding 2,000 tons. From this bunker the coal is transported nearly half a mile across the storage ground to a central crushing station at a rate of 250 tons an hour by a system of rubber belt conveyors. Coal not required for immediate use is discharged on to the storage ground, where it is stacked and later reclaimed for return to the belts by a large travelling crane at the rate of 150 tons per hour. The stock of coal maintained is usually 40,000 tons. From the crushers the coal is delivered into overhead bunkers in the retort houses, holding 30-48 hours' supply.

Wherever possible mechanical handling has been adopted on the works. The coke, on leaving the retorts, is removed either hot or cold from the houses by gravity bucket, or drag bar conveyors, and discharged into storage hoppers. These are conveniently situated and constructed for delivery into customers' road and rail vehicles and river barges, and for Works use in producers, for retort bench heating or water gas manufacture, and so forth. Coke grading and washing plants and ash separating plants also form part of the equipment. For transport about the works there is a full-gauge railway system and also a service of steam lorries.

Carbonization is carried out in two of the retort houses by the use of horizontal retorts of recent design, and in two others by continuous carbonization in vertical retorts. The two horizontal retort houses, which are similar in construction, together contain 400 D-shaped retorts, with Fiddes-Aldridge Stoking Machines.

In the older vertical retort house there are 128 retorts of the Glover-West type. The capacity of this installation is 420 tons of coal per day, from which are produced 33,000 therms (or 6,500,000 cu.ft.) of 510 B.Th.U. gas.

The second vertical retort house contains 72 Woodall-Duckham retorts, carbonizing 646 tons of coal a day, representing 51,000 therms (or 10,000,000 cu.ft.) of 510 B.Th.U. gas.

Partly in order that rapid fluctuations in demand may be met, water gas plant is installed at Fulham in accordance with the Company's usual practice. Two of the three sets are fitted with oil carburettors and superheaters. The plant can gasify 74 tons of coke and up to 5,000 gallons of oil daily, producing therefrom 4,000,000 cu.ft. of gas, the quality of which can be varied between 300 and 520 B.Th.U.

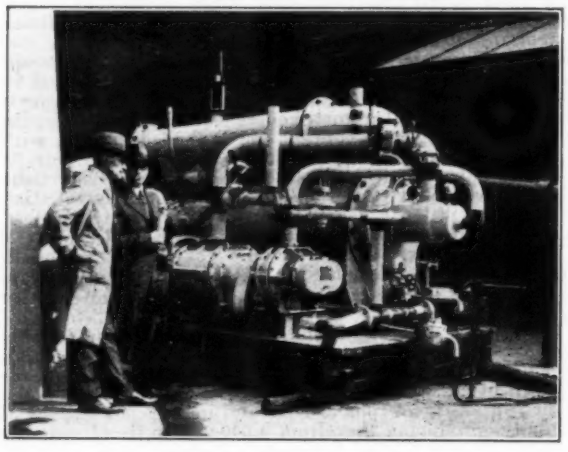
The water gas units and most of the carbonizing plant are fully equipped with steam boilers for recovering heat from the various spent heating gases passing away to the

From *Left to Right*.—Mr. H. Hollings, Mr. J. S. Thorman, Mr. A. Coe (Principal, The Gas College, Halifax), Mr. T. C. Finlayson (Woodall-Duckham Companies), Dr. S. Pexton (Senior Research Chemist, Fulham Laboratories), Mr. Thorman, Dr. R. H. Griffith (Senior Research Chemist, Fulham Laboratories), and Mr. P. H. Hornby (Deputy Engineer, Fulham).

atmosphere. The total amount of steam so raised is about 89,000 lb. per hour, which amounts to 90% of the total requirements for power and for process work. Much of the plant is driven direct by steam engines, but for transmission of power to the retort houses, conveying plant, and coal unloading wharf, &c., electricity is found convenient, and the following units are installed: 1,875 and 750 kW alternators, 500 and 228 kW generators, and one 150 kW gas engine unit.

On leaving the manufacturing plant the gas from each retort house and from the water gas plant passes through its own section of condensing, exhausting, and purifying plant. Each stream is finally separately metered. By this means accurate control is secured and the cycle of operations simplified, while the results from the various types of plant in use can be recorded. Except that there is no ammonia or naphthalene to extract from water gas, the treatment of the coal and water gas streams is identical.

The ancillary plant includes plant for handling, screening, cutting, grading, and washing coke to make it ready for the market. Fulham is one of the principal stations from which the supply of coke for open fires and domestic hot water boilers is carried out, and the new coke plant at this Station was designed by the Company's own staff. It is over 100 ft. high and the storage bunkers have a capacity of 2,000 tons. The conveyors carrying the coke through the plant, and the machinery itself, are all electrically interlocked in series so that in the event of the stoppage of any one section, all the preceding plant is immediately and automatically brought to a standstill.



The Holmes Holder Purging Plant on View at Fulham.

In 1934 a Birtley dry cleaning plant was added, including the necessary conveyor belts for carrying the coke to and from the table. In 1933 a Holmes benzole plant was installed, comprising three 12 ft. diameter washers, a 7 ft. diameter still; also oil heaters, condensers, coolers, and six underground tanks for oil and benzole storage.

A very large number of motors and carts are required for the delivery of the coke in this and neighbouring areas and three large garages and a stable for 30 horses have been erected. The total number of motors stationed at Fulham is now 170.

A second visit was paid on June 3, at the conclusion of which tea was again served in the dining-room of Watson House; and then Mr. HAROLD C. SMITH, President-Elect of the Institution, rose to propose a vote of thanks. This was, he said, yet one more occasion when the Institution was able to express deep gratitude to the Governor, Directors, and Staff of the Gas Light and Coke Company. In fact, if such a proceeding were not likely to smack of insincerity they might really keep a stock of circular letters and hand one to Sir David on each such occasion. Once again they had had a remarkable visit. What they had seen was really staggering, and he had no doubt that if they came again in two months' time there would be something fresh to see. There was no end to the progress of the Gas Light and Coke Company. This, Mr. Smith continued, was the first opportunity which occurred at a meeting of the Institution to tender to Sir David Milne-Watson their hearty congratulations on the Baronetcy conferred upon him.

Sir DAVID MILNE-WATSON, in reply, said it had given the greatest pleasure to him and to his Directors to see so many present on both days. His Company had tried for many years to do the best both for themselves and for the Industry as a whole. They realized that they had comparatively enormous resources, and they felt themselves responsible to the Industry to do for the common good what was not within the scope of other smaller concerns. They wished to have no secrets; they were the more pleased the more questions people asked. He appreciated what Mr. Smith had said about new things to see—even he, Sir David, on his frequent visits always found something new at Fulham. He thanked them for their congratulations upon his Baronetcy; he felt that it was given quite openly "for gas." (Laughter.) There had been in the Official Gazette no mention of political services—he had been described merely as "President of the National Gas Council." And so he felt that the Industry as a whole shared his honour.

CHEMICAL RESEARCH LABORATORIES

The Gas Light and Coke Company's Research Laboratories at Fulham were erected in 1927 for the extension of the scientific control of the gas-manufacturing side of the Company's activities as distinct from the manufacture of marketable by-products and from the gas utilization side. They are concerned in the main with research on the processes of coal carbonization, coke gasification, and gas purification and on problems arising therefrom. Close contact is maintained with the works laboratories at each of the twelve manufacturing stations of the Company by means of a committee of chemists meeting periodically at the Fulham laboratories.

The work undertaken includes the investigation of the underlying fundamental chemical, physical, and engineering principles, and the development therefrom of new and improved processes, together with large scale studies of efficiency of existing plant.

For the full-scale investigation of carbonizing problems with the use of comparatively small quantities of material, the equipment includes an experimental carbonizing plant adjoining the retort houses.

The laboratories are also concerned with questions relating to the manufacture and utilization of coke, part of this work being carried out for the London and Counties Coke Association.

High-pressure work on hydrogenation of tar and carbon reactivation is carried out in an annexe to the main laboratory building.

The equipment in the laboratories illustrates some of the work in progress, which may conveniently be classified into the sections below:

Experimental Carbonizing Plant.—This consists of a setting of two D-shaped horizontal retorts, 23 in. by 16 in. by 20 ft., complete with coal-weighing apparatus, and connected to its own exhauster and purifying plant. Coke produced on the experimental plant and from other sources is examined in No. 1 Laboratory for combustibility, reactivity, &c.

Proximate Analysis.—The method used for volatile matter determination is of interest. The crucible containing the coke is heated in an atmosphere of pure nitrogen in a gas-fired muffle. Work is also in progress on the measurement and analysis of the gases evolved on heating coke under low pressures.

Combustibility.—This is measured by the C.A.B. test of the Northern Coke Research Committee, in which a graded sample of coke is ignited by means of a standard electric current and the minimum air rate necessary subsequently to keep it just burning is measured.

Reactivity towards carbon dioxide or steam can also be measured while work is in progress on the chemical reactivity of coke by means of its oxidization with chromic-phosphoric acids.

Coke Burning Appliances.—The gravity feed thermostatically-controlled boiler was developed, and examples of two such boilers will be found in the laboratory boiler-room. Owners of hand-fired boilers who desire to install automatic stoking have the choice of two stokers specially suited for coke. At present these stokers can only be operated on a small size of coke, of which supplies are limited, and attempts are being made to modify the design so as to utilize a larger size of coke.

There will shortly be available a British Standard Specification covering the small boilers for domestic hot water and the tests to be applied to them. These standard efficiency and overload tests are carried out at Fulham. Two

examples of domestic boilers, suitable for combined central heating and hot-water supply, which incorporate thermostatic control and the gravity feed of coke, are under examination.

Apart from the testing of appliances submitted by makers, there is in progress research relating to the influence of several features of boiler design upon the combustion of coke. Special attention has been directed to the gas ignition burner of open coke grates, and to the use of coloured vitreous enamels and various bright metal finishes.

A semi-producer suitable for a grass-drying plant was erected and tested at Fulham. This design has now been adopted by several makers of grass-drying plants, and one has been recently installed on a Curtis dryer at a farm at Chessington. A description of this plant was given in last week's "JOURNAL."

Gas Purification.—Many of the operations in gas purification are concerned with the transfer of material from the gas phase to a liquid phase in contact—*e.g.*, the absorption of ammonia by liquor, of benzole and naphthalene vapours by gas oil, or of water vapour by calcium chloride solution in the gas-drying process.

In No. 2 Laboratory investigation of co-efficients of transfer on the semi-works scale is carried out in an experimental tower-scrubber plant. A new type of gas-drying tower has been developed from this work for use on the outlet of holders and an improved liquor distributor devised for use in such plant is also shown in No. 2 Laboratory. Diffusivities of a number of solutes in various liquid absorbents are being determined by the use of the McBain cell. The relationship of diffusivity to viscosity is being investigated for the determination of relative transfer rates by reference to viscosity data. Data on mass transfer in bubble-cap columns are being obtained from a laboratory apparatus in which a reproduction of a single slot from a commercial still is tested. This work has particular reference to the stripping of wash oil in benzole recovery plants.

Rates of transfer in two-liquid systems are studied in an apparatus in which a solute is transferred from bubbles of one liquid to another through which they are flowing.

Benzole Extraction with Sulphur Removal.—Plants have been in operation for the treatment by active carbon of the whole of the coal gas made at the Beckton and Harrow Works for a number of years. In the early plants trouble was experienced with the internal corrosion of the coils used for heating and cooling the active charcoal. The various systems adopted to eliminate the trouble are illustrated by diagrams and a working laboratory model.

A special process of benzole recovery using about 30 gallons of oil per 1,000 cu.ft. of gas whereby nearly twice as much sulphur is removed, has been developed and put to work for the treatment of 10 million cu.ft. of coal gas per day at the Kensal Green Works. Photographs of the plant are exhibited. With the extension of heat exchange apparatus in benzole plants, the importance of non-sludging oils increases. An apparatus for determining the sludging characteristics of wash oil is exhibited.

Nitrogenous Gum.—Apparatus is exhibited in which the formation of gum particles is being studied by means of the ultra-microscope and the thermal precipitator. Apparatus for the determination of traces of nitric oxide in gas is also exhibited, together with a catalytic process for the removal of nitric oxide from gas on a semi-technical scale.

Gas Analysis.—It has been found necessary to develop several new methods of gas analysis. The constant volume apparatus incorporating a gas-heated copper oxide tube for the combustion of methane and hydrogen is suitable for general use. For some research purposes parts of the apparatus are steam jacketed. Gas analysis by liquefaction and fractionation has been developed also.

High-Pressure Research.—High-pressure hydrogenation has been applied for the production of low-boiling fractions from coal tars or tar oils and for the re-activation of active charcoal which has become fouled during use in benzole recovery plant. High-pressure treatment with hydrogen has been found to remove the fouling material deposited in the active charcoal during its use. This process is operated on the batch principle and entails no loss of charcoal.

Analysis of Stores.—Many types of stores are purchased to specification involving chemical analysis; examples of such stores are illustrated in No. 3 Laboratory, and a few analytical methods are demonstrated.

Gas-Works Analytical Methods.—In No. 3 Laboratory some of the methods used for the works control of gas manufacture and purification are demonstrated. Tests which are applied to determine calorific value and other properties of gas are also illustrated.

THE HARWOOD TERRACE STOVE WORKS

The Harwood Terrace Stove Works were erected in 1895 as a combined stove repairing and meter testing depôt. It is one of three similar works of the Company. The continual increase in the Company's business had made it necessary from time to time to extend the original premises, but by 1922 it was not possible to carry on the work satisfactorily without further extensions.

The extensions, constructed in reinforced concrete, were finished in 1927. Since that time the work has continued to increase, and a motor repair shop at the far end of the works was taken over and converted to an additional repair shop and store in 1934.

The works deals with all apparatus requiring renovation from an area west of a line drawn from Westminster northwards and the west side of Camden Town. The number and types of apparatus actually repaired during the year 1936 were as follows:

Fires	26,706
Radiators	5,199
Cookers	42,640
Grills, &c.	1,897
Water heaters	5,023
Wash coppers	2,135
Iron and sundries	525
Refrigerators	1,466
Total	85,591

Apparatus returned from the district is received on the unloading site outside these stores. Those which are not required for orders in hand are removed to the old stove store behind, the heavier appliances remaining below, and the fires, &c., being taken to the floor above.

Enamelled cookers are dismantled and placed in cages, lowered into vats containing a cleaning solution, cleaned, and afterwards taken to the main shop for assembly. In the case of black cookers, after the removal of the brasswork, they go forward to the muffle room. There are two muffles with travelling platforms on rails, each capable of taking eight ordinary cookers and boxes of fittings, or sixteen small cookers at one time. As one platform is pulled out another is pushed in from the opposite end, and the loss of heat is reduced to a minimum.

After burning off, the cookers are taken to the shot blast plant adjoining the muffles, and are cleaned by means of a jet of steel shot.

Thermostats, governors, and feed bars are repaired, cleaned, and tested in another shop set aside for this purpose only.

Adjoining the stove shop are the material and general stores from which all materials are supplied to the fitters, and to the districts which this depôt serves.

In the japanning and colour shop, all fires, new and renovated, are coloured in the Company's standard colours. There are 13 cubicles, 3 japanning ovens, and a stoving conveyor, the maximum output from this shop being 500 fires per day. Each coloured appliance has three coats, and undercoat, colour, and lacquer, and stoved at 250° F.

New apparatus is received from manufacturers in the despatch warehouse, where it is examined for correctness to sample held in the sample room, 5% being subjected to the Company's proving test. Periodically samples of deliveries are taken by Watson House, where they are tested and dissembled for gauging of parts, &c.

Renovated appliances from the shop also pass into these stores. If they are required for delivery the following day they are taken direct to the loading bank. Here also coloured fires are received from the colour spraying shop, wrapped ready for issue.

The stores have capacity for about 5,000 cookers and 10,000 fires.

It is possible to load twenty-five lorries at once, and during the past winter as many as fifty lorries filled with appliances have been sent out in one day.

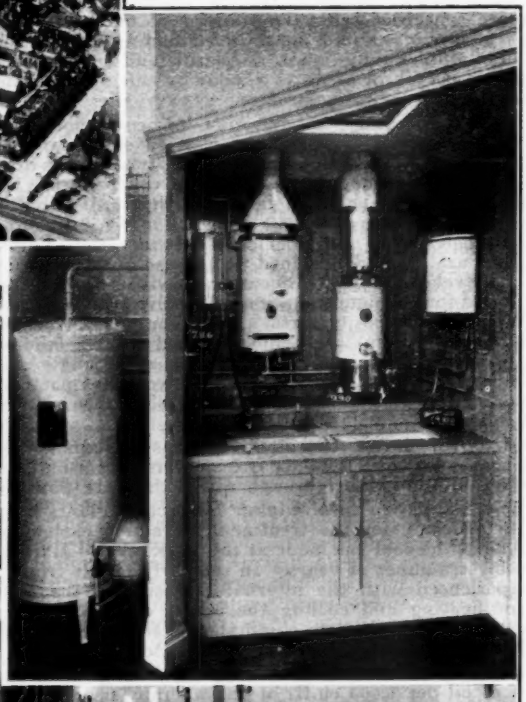
The whole of the works, stores, and offices, is heated by a system of hot-water pipes. Two large Robin Hood coke-fired boilers, situated in a pit below the loading bank, serve the new buildings with two smaller ones for the old buildings.

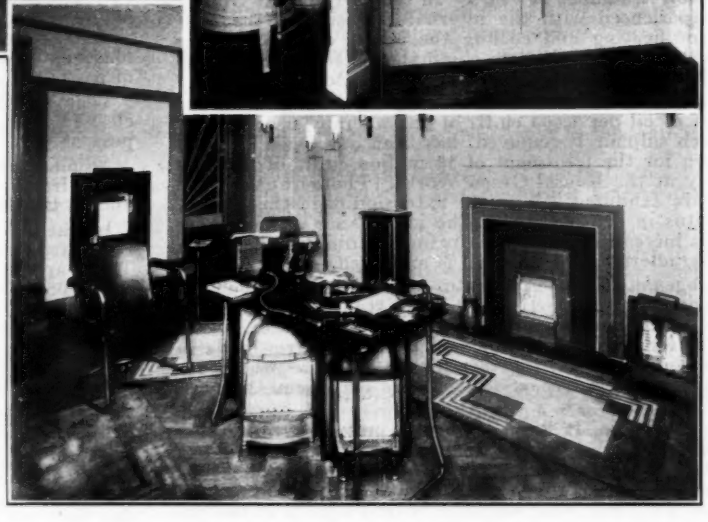
With a view to ensuring a good supply of trained maintenance fitters for the Company's Gas Sales Department, those undergoing training at Watson House are given a 12 months' training at the stove works before being transferred to the various District Offices as fitters' mates.

The training is both practical and theoretical and is so arranged that both branches run parallel.

A MEMORABLE DAY IS SPENT AT Folkestone

In the accompanying photographs we see an aerial view of the town, which includes the gas-works in the centre, together with three glimpses of the attractive showrooms of the Folkestone Gas and Coke Company.





Take the blue sky, multi-coloured sea, green fields heavily besprinkled with buttercups, and white cliffs, which are the glory of the free-born Briton. Mingle with these the beauties which are inherent to the superior sex among themselves, exquisitely laid-out gardens, and a generous proportion of the marvels of modern science, and who could demand better materials for the making of a perfect picture? All this, and more—for a delectable "atmosphere" was diffused by generous hospitality and the spirit of real comradeship—was enjoyed by the 300 or so members and friends who journeyed by special train to Shorncliffe Station on Friday morning. And the Southern Railway showed themselves to be "in line" with the occasion, by providing a particularly comfortable train, and by making all possible arrangements for the comfort of the travellers.

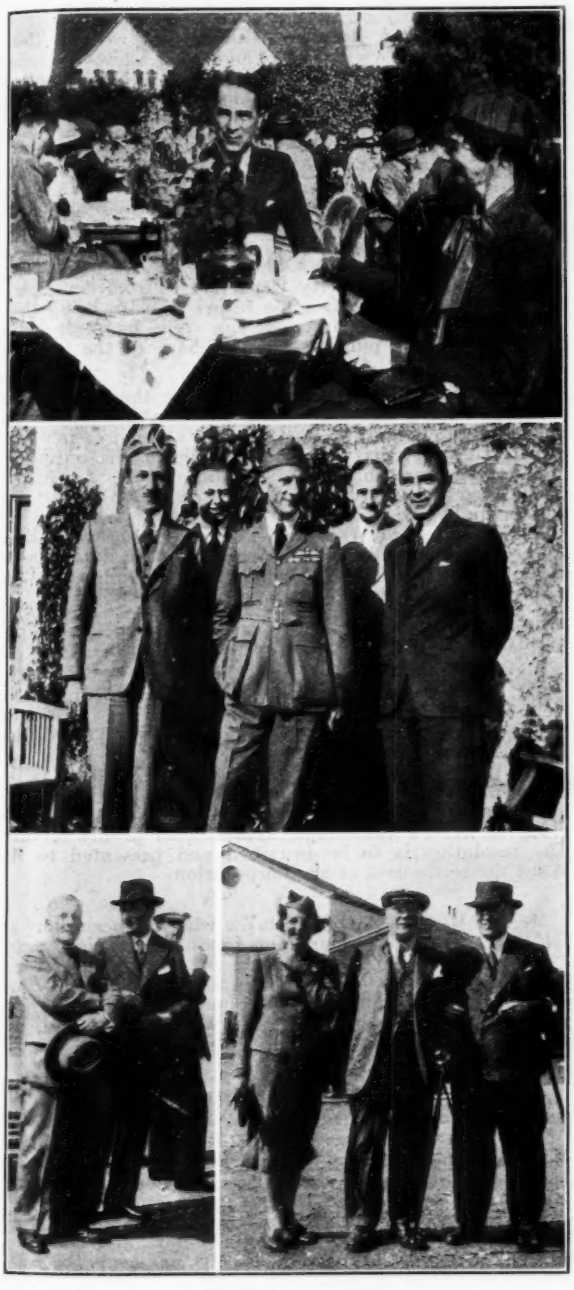
On detraining, those of the party who could not for a day tear themselves from the main preoccupation of their lives proceeded to investigate the Gas Company's activities, but a more subtle programme than this had been arranged for the larger number who elected to take part in the drive; for this drive had been planned, while affording a glimpse, in passing, of the Company's showrooms, to give the visitors a vivid and lasting impression of that larger and more irresistible showroom which is Folkestone. How many new friends must Folkestone have made when the string of motor coaches, having proceeded through the lower parts of the town, passed up Dover Hill, to a viewpoint overlooking the Warren, where a halt was made, in order that all the varied beauties of this show place of the district might be appreciated to the full.

The Gas Company's Welcome.

The drive was then resumed to the Hotel Metropole, on The Leas, where the visitors were the guests at luncheon of the Folkestone Gas and Coke Company. Mr. R. W. Foot (Director), who presided, explained that he was a very humble deputy for the Chairman of the Company, Sir David Milne-Watson, who was unable to be present, and had written: "I am very sorry I shall be unable to be at Folkestone to-morrow, and therefore shall not be able to preside at the luncheon. I shall be glad if you will convey to all our guests, including members of the Institution and their ladies, my regret at not being able to welcome them personally."

Mr. Foot went on to remark that this was why he was welcoming them, as one of the Directors of the Folkestone Gas Company. He was glad to have supporting him another Director of the Company, Mr. G. M. Gill. In a few words, he would like to tell them how delighted Mr. Gill and he were, as Directors, to be present to receive so many distinguished and charming guests around their board that day. They were very sorry that Sir Philip Sassoon was unable to be with them, but he had kindly

placed his gardens at their disposal for that afternoon—a privilege for which they must all feel grateful to him. He would also like to take this opportunity of thanking Wing Commander Morgan, who was in charge of the station at Lympne, for the treat he had promised for the afternoon in showing them what the R.A.F. could do in the air. All would have liked to have the Mayor of Folkestone with them at the luncheon, but unfortunately he was prevented by ill-health from being present. They were, however, very pleased to see Councillor Saunders, the Deputy-Mayor. Because there were very few hosts, and so many guests, was why the Folkestone Gas Company were enjoying themselves that afternoon.



At Lympne

Proceeding to submit the toast of "The Guests," Mr. Foot said he would like to assure the Deputy-Mayor that it was the very definite policy of the Folkestone Board to encourage in every way the enterprise of the Corporation. The Company had in Mr. Diamond (the Engineer and General Manager of the Folkestone Gas-Works) one of the most able and energetic members of the Gas Industry; and with his aid the Directors wanted to do all they could to help in the further development of this charming and prosperous borough. [Applause.] He believed that the institution, as a body, were visiting Folkestone that day for the first time in 74 years, but the Company hoped it would not be the last occasion upon which they would be privileged to receive the members and their ladies. "Mr. Lacey," concluded the Chairman, "the Folkestone Gas Company would like to congratulate you on what is acknowledged on all sides to have been a very successful year of office. [Applause.] The Institution has had a very distinguished line of Presidents from towns all over the country. It has been doing more and more as years have gone by for the Industry of which we are all so proud, and I am inclined to think that, when 1936-37 comes to be recorded in the history of the Institution, it will take its place as a year well worthy of the past."

The Deputy-Mayor was on perfectly safe ground when, in responding, he expressed the hope that the guests would enjoy their visit, and that they would go away with many happy memories of Folkestone.

Mr. Lacey said this was the last time he would have the honour of speaking as President of the Institution, and he felt gratified that it should be on so delightful an occasion, and that his final words should be to thank the Folkestone Gas Company for having rounded-off so successful an annual meeting in so pleasant a way. Mr. Diamond had done excellent work in organizing, with the Secretary of the Institution, that day's visit. They were all proud of Mr. Diamond, for they knew he organized the Folkestone Gas Company as well as he had organized that visit.

In the Air.

Perhaps it is as well that "gas" people should not be too "air" minded. At any rate, many there were who did not seize the opportunity which during the afternoon presented itself of taking a trial flight. But, even so, the visit to Lympne Aerodrome proved absorbingly interesting. The aerodrome, which is the headquarters of Bomber Squadrons Nos. 21 and 34 and of the Cinque Ports Flying Club, is about eight miles from Folkestone, on the heights overlooking Romney Marsh, so that by just clearing the trees fringing the main road the aviator immediately finds himself at a considerable altitude. Both the Bombing Squadrons named did valuable work during the Great War, and the visitors witnessed striking demonstrations of their prowess; while the Flying Club, with its extensive fleet, mostly of Moth aeroplanes. offered short flights—some of them free—to the owners of programmes bearing lucky numbers.

Totally different, but equally imposing, were Sir Philip Sassoon's gardens at Port Lympne, which are admittedly among the finest in the country. Commandingly situated in a terraced position overlooking the whole expanse of Romney Marsh, and providing magnificent views extending to the Fairlight Hills and across Dungeness, the gardens are laid out and stocked in almost every conceivable manner—even to containing a small vineyard and numerous fig trees, to say nothing of a fine swimming pool. The charming Kentish home to which the gardens are attached was visited quite recently by Her Majesty Queen Mary, and it also made history when it was the scene of a meeting of the Peace Conference which took place just after the Great War.

Tea in another entrancing spot—the gardens of Lympne Castle, situated on the crest of a ridge of hills overlooking on one side the Straits of Dover—brought to a close what had been throughout the day a veritable feast of beauty and interest. There remained only a comfortable journey back to Victoria, a last word of thanks to a genial President, handshakes with friends on the platform, and in the case of others besides the writer a feeling of regret at taking leave of Secretary "Alec," who has long been a good friend, as well as a "whale" of an organizer.

News in Brief

CURRENT EVENTS IN THE GAS INDUSTRY

A Generous Contribution of £210 has been made by Messrs. R. & A. Main, Ltd., to the Falkirk and District Royal Infirmary Nurses' Home Appeal.

A Site in the Market Place is to be purchased by the Oldham Gas Department at a cost of about £6,000 for the purpose of establishing new showroom premises.

An Outbreak of Fire occurred at the Dundee Corporation Gas-Works on June 3. The outbreak, which was confined to part of the stores building, was quickly extinguished.

Applications Are Invited for the position of Engineer, Manager, and Secretary of the Peterborough Gas Company at a salary of £1,000 per annum. Further particulars will be found in our advertisement columns.

Dividends are recommended by the Directors of the Plymouth and Stonehouse Gas Light and Coke Company for the half-year ended March last at the rate of 8% per annum on the ordinary stock, 13s. 6d. per share on the "additional" shares, and 13s. per share on the "New" shares, less income-tax in each instance.

A Requisition Has Been Signed by six members of Kirkcaldy Town Council calling a special meeting of the Council at which it will be asked that work shall cease forthwith on the erection of the new gasholder in Links Street, requesting the Gas Committee to find another site. A meeting of ratepayers has sent protests against the erection on its present site to the Secretary of State for Scotland, the Department of Health, Mr. T. Kennedy, M.P. for Kirkcaldy Burghs, and the Town Clerk.

Gas Meter Testing at Birmingham

Committee of Justices' Report

The report of the Gas Meter Testing Committee of the Justices of the City of Birmingham for the year ended March 31, 1937, states that the number of meters tested during the year amounted to 90,598, as against 86,482 last year. The income during the year was £6,378, and there is again a substantial contribution to the rates of the City, which this year amounts to the sum of £2,535.

Nearly 2,570 meters, or 2·83%, were rejected, against 1,961, or 2·26%, last year. Of the 2,568 meters rejected, 601 were more than 2% fast, 637 were more than 3% slow, and 419 were rejected for unsoundness. The rejections for excessive absorption of pressure number 527. Disputed meters submitted for re-verification and certification totalled 110, of which 81, or 73·63%, were incorrect. Of the 90,598 meters tested, the standard and high-capacity type numbered 65,308, repaired meters 35,443, and pre-payment meters 63,075. The highest monthly percentage of rejections was 3·98% and the lowest 2·19%.

Thousands of Barnsley Housewives availed themselves of the Kitchen Fashions and Food Shows organized by the Sheffield Gas Company. We gave full details of this ambitious programme in which the Company had the co-operation of the Barnsley British Co-Operative Society in the "JOURNAL" for May 26.

For New Showrooms, the Oldham Gas-Works Committee is to purchase a site at Market Place. At the Town Council meeting, Councillor J. L. Wilkinson objected to the setting up of a new gas showroom, stating it would be preferable for the gas and electricity premises to be in one building. Alderman Kenyon replied they could not stop the Gas or Electricity Departments from developing, but if it was possible at some future date to bring these Departments together into one big civic centre it would be better for the public. The purchase of the site was approved.

Such Attention Was Attracted by the sight of an artist executing lightning cartoons in a window of the Torquay and Paignton Gas Company's premises in Union Street, Torquay, that it was impossible to give an exhibition lasting more than three or four minutes for fear of causing too large a crowd to collect. The artist, who spent the fortnight ended Saturday, May 29, at Torquay, was Miss Kay Morris, of the B.C.G.A. The longest time Miss Morris spends on any of her cartoons, which illustrate the exploits of "Mr. Therm—Public Servant No. 1," is one hundred and ten seconds.

Personal

Mr. F. E. WARD, Engineer and Manager of the St. Helens Gas Department, has submitted his resignation to the St. Helens Gas and Lighting Committee. The resignation is to take effect from Sept. 30.

Mr. Ward has been engaged in the St. Helens Gas Department for about forty years and was appointed to his present post in 1922. The Committee have decided to place on record their high appreciation of his services. The resolution is to be inscribed and presented to Mr. Ward under the seal of the Corporation.

* * *

Mr. H. V. PYE, A.M.I.Mech.E., who has been chief assistant to the Peterborough Gas Company for eight years, has been appointed Manager and Secretary to the Tavistock Gas Company. Educated at Epworth College, Rhyl, Mr. Pye, before going to Peterborough, was ten years with the Chester Gas Company, where his father was Manager and Secretary.

Obituary

The death has occurred of Mr. R. WARDELL, Engineer, Manager, and Secretary of the Peterborough Gas Company.

Forthcoming Engagements

June.

10.—ASSOCIATION OF STATUTORY INSPECTORS OF GAS METERS.—Visit to Beckton, 2.30 p.m., preceded by lunch at the Town Hall, Barking.

17.—S.B.G.I.—Council Meeting, 56, Victoria Street, S.W. 1, 11.30 a.m.

18.—I.G.E.—Special Council Meeting, 2.30 p.m.

18.—NORTH OF ENGLAND ASSOCIATION (AUXILIARY).—Meeting at Middlesbrough.

18.—WAVERLEY ASSOCIATION.—Annual Meeting at Edinburgh.

19.—LONDON AND SOUTHERN JUNIORS.—Summer Visit to Luton.

21.—LONDON AND COUNTIES COKE ASSOCIATION.—Executive Committee, 11.15 a.m. Central Committee, 2.30 p.m.

23.—I.G.E.—Pipe Committee, 3 p.m.

24.—SOUTHERN ASSOCIATION (EASTERN DISTRICT).—County Meeting at Luton.

25.—I.G.E.—Joint Lighting Committee, 2.30 p.m.

25.—B.C.G.A.—Scottish Conference at Peebles Hydropathic.

(There will be no meeting of the Central Executive Board of the National Gas Council during the month of June.)

July.

2.—I.G.E.—Joint Committee on Complete Gasification under Pressure, Department of Scientific and Industrial Research, 16, Old Queen Street, S.W. 1, 3 p.m.

9.—SOUTHERN ASSOCIATION.—Summer Meeting at Southampton.

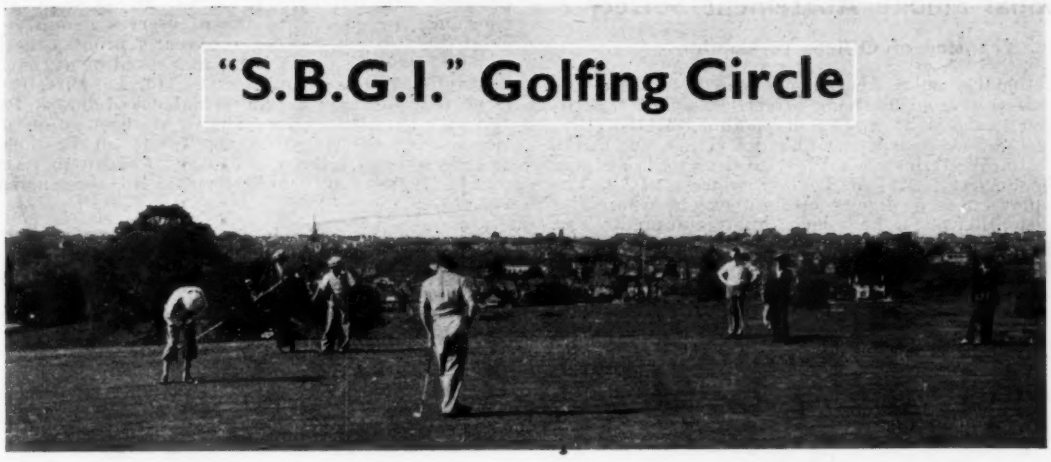
13.—I.G.E.—Council, 10 a.m.

15.—I.G.E.—Gasholder Committee, 2.30 p.m.

Sept.

9-10.—NORTH BRITISH ASSOCIATION.—Annual Meeting at Edinburgh.

"S.B.G.I." Golfing Circle



Highgate Golf Club, May 31, 1937

On Monday, May 31, the Golfing Circle of the S.B.G.I. held their Spring Meeting to which, following the custom of recent years, Members of the Institution were invited

Highgate is the golfing home of the President of the Institution, Mr. Stephen Lacey; indeed he is Hon. Treasurer of the Club. The excellence of the welcome extended to the members may have been due in some measure to this connection, though it was so spontaneously offered by the Hon. Secretary, Colonel A. C. Soutten, and all his staff that we feel sure it would be equally extended to any visitors who are fortunate enough to play at Highgate. Every possible compliment was paid to the members of the Circle and their guests, including that of the "Tiger" tees. The course was in excellent order, and it was difficult in the glorious weather that prevailed and among the most delightful surroundings of the tree clad course to believe that it is situated within 5 miles of Charing Cross.

Mr. Lacey attended the luncheon and afterwards took part in the foursome competition partnered by the Captain of the Circle, Mr. Rex Chester, but to the general regret even the combined skill of two such well known golfers added to the local knowledge of the Institution President was not sufficient to win them the prize. There can be no doubt that the cares of their respective offices were on this occasion weighing heavily upon them.

The customary competition for the Thornton Victory Cup for members of the S.B.G.I. only was held in the morning. In addition to this members of the Institution were invited to play for the Coronation Plate—a new trophy which has been presented by the Golfing Circle for annual competition.

Excellent as was the total attendance, it was perhaps rather disappointing on such a beautiful day and amid such delightful surroundings that more members of the Institution were not able to turn out to compete for this new trophy. It is difficult to imagine a better preparation for the really hard days of the remainder of Institution Week than a day's golfing with the Circle for which such admirable arrangements are invariably made by the Hon. Secretary and Treasurer, Mr. W. R. Edgar.

The following were the results of the various competitions:

CORONATION PLATE.
[For Institution Members only.]
W. E. Dean, Exmouth.

THORNTON VICTORY CUP
[For S.B.G.I. Members only.]
F. D. Drake.

FOURSOMES AGAINST BOGEY.
[For Prizes presented by Col. O. B. F. Planck.]
W. H. G. Roach.
C. H. Chester.

The President of the Institution, with the Captain and the Secretary of the Circle and the Prize Winners.

National Smoke Abatement Society

Transfer of Offices to London

The National Smoke Abatement Society's offices are being transferred from 36, King Street, Manchester, 2, to London, and on and after Thursday, June 24, 1937, the address of the Society will be: Chandos House, 64, Buckingham Gate, Westminster, S.W. 1. Telephone: Victoria 7359. The Society's present London address at 71, Eccleston Square, will no longer be used except where the personal attention of Sir Lawrence Chubb is desired. The addresses of the Scottish, Manchester, Salford, and District Branches will remain as at present.

Yorkshire Junior's Short Paper Meeting

Presidential Emblem of Office Presented to the Association

On Saturday, May 22, a meeting of the Yorkshire Junior Gas Association was held at Halifax. Fifty Members met at the Gas-Works, Mulcture Hall Road, Halifax, at 3 o'clock, where they were officially welcomed by the Mayor of Halifax, Councillor C. Hodgson, J.P., the Gas Committee, and Mr. W. McLusky, Engineer and Manager.

The members then inspected the Works. After tea Mr. Halkett, Junr., presented the Association with an emblem of office in the form of a medallion and ribbed silk collar to be worn by the President of the Association. Mr. Halkett said that he had long thought that the dignity of the President's Office should be marked in some way, and he felt that this was the appropriate occasion when he should present the Association with an emblem of office for the President. The President, Mr. E. R. B. French, accepted the emblem on behalf of the Association, and said that it was a very handsome piece of craftsmanship, of which the members could justifiably be proud; he would be honoured to wear it. Mr. J. Richmond, Senior Vice-President, endorsed Mr. French's remarks, of which he was sure all members would heartily approve.

Mr. French then introduced the members who were to read Papers. Mr. C. J. Dougherty (Leeds) read a Paper on "The Domestic Coke Load," Mr. J. Castle (Brighouse) read a Paper entitled "Aspects of Pre-Heating in Dry Purification," and Mr. F. J. Pratten (Shipley) read the last Paper entitled "Choosing the Correct Appliance." The first two of these Papers appeared in last week's issue, and it is hoped to publish the last one in an early issue of the "JOURNAL." There followed a short discussion on the Papers, and a vote of thanks was given to the speakers.

Mr. T. E. Parry (Bingley) moved a vote of thanks to the Halifax Gas Committee and the Halifax Gas Department, and Mr. F. Beaumont (Huddersfield) seconded that motion.

James Keith & Blackman Co., Ltd.

Change of Name Proposed

Among the resolutions to be submitted at an Extraordinary General Meeting of Messrs. James Keith & Blackman Co., Ltd., to be held at the Memorial Hall, Farringdon Street, E.C. 4, on Friday, June 25, after the Ordinary General Meeting of the Company convened for the same day, will be that the name of the Company be changed to "Keith Blackman, Ltd."; that each of the 200,000 Ordinary Shares of £1 each (all of which are issued and fully paid) be sub-divided into two shares of 10s. each; and that the capital of the Company be increased to £500,000 by the creation of 150,000 new 5½% Cumulative Preference Shares of £1 each (ranking *pari passu* with the existing Preference Shares of the Company) and 200,000 new Ordinary Shares of 10s. each.

The annual report of the Board of Directors states the amount of business done during the year considerably exceeded that of the previous year. After providing for payment of Preference Dividend, and making sufficient allowance for depreciation and reserves against doubtful debts, and income-tax on the year's profits, the audited accounts show an available balance standing at the credit of the profit and loss account of £58,416. The Directors recommend that this sum be appropriated as follows: Declare a dividend on the Ordinary Shares at the rate of 20%, less income-tax, absorbing £30,000; write off Freehold Land and Buildings, Arbroath, £5,000; transfer to reserve account £10,000; and carry forward to the current year £13,416.

Five Years' Lighting Contract at Knottingley

Council House Installations

The Knottingley Gas Company have secured the contract for the public lighting of Knottingley for a further five years.

In addition, the Company had secured the contract for a supply of gas for lighting and gas coppers for seventy-six council houses at the Broom Hill Council Estate and the contract for a supply of gas and fittings for lighting 156 council houses at England's Lane, Knottingley. All three contracts have been secured against keen electrical competition.

Steel Furnace Fired by Gas

Lanark Installation

The Steel Company of Scotland, Ltd., Hallside Works, Newton, Cambuslang, Lanarkshire, are installing two new furnaces at their works and have asked the Lanark County Council for a supply of gas for one of the furnaces.

Although the larger of these two furnaces is to be supplied with gas from the Company's own producer, it is desired that gas be supplied for the small one from the County Council Gas Undertaking. The furnace would require approximately 35 million cu.ft. of gas per annum, and there would be work for the plant for about three years. The supply to the furnace would necessitate the laying of a new gas main at a cost of £1,240.

The Gas Committee have, therefore, decided to request the Company to give a guarantee of £450 per year and that towards this might be credited each year a sum of 4d. per 1,000 cu.ft. of gas consumed and paid for by the Company, which has expressed its willingness to pay 1s. 3d. per 1,000 cu.ft. for the supply.

Airdrie Seek a Bulk Supply

Carbonizing Plant Out-of-Date

Faced with an expenditure of from £20,000 to £23,000 in replacing obsolete plant at the Corporation Gas-Works, the Airdrie Town Council have invited Coatbridge Gas Company to consider supplying the Burgh with gas.

Some months ago it was reported to the Gas Committee that the horizontal carbonizing plant had become out-of-date, and application was made for the installation of more modern plant. Consideration of new plant has been deferred while the committee sought other means of meeting the situation. Enquiries were made as to the possibility of a West of Scotland Gas Grid Scheme being introduced, but on the idea falling through offers were invited for the installation of vertical retorts. Four offers have been made, ranging from £20,000 to £23,000. At a meeting of the Gas Committee on May 24 the Town Clerk was instructed to write the Coatbridge Gas Company suggesting an interview with the sub-committee to discuss the terms and conditions upon which the Company would be prepared to undertake the supply of gas in bulk to the Burgh either (1) at Burgh boundary at Coatdyke, or (2) into the gasholders at the Gas-Works, and also what reduction per therm or per 1,000 cu.ft. the Company would be prepared to make in the price of gas supplied in the event of coke oven gas being available from Messrs. Baird & Co.'s Works at Gartsherrie.

The cost of gas in Airdrie at present is 1s. 0½d. per therm, while Coatbridge Gas Company produces gas at a rate of 8d. per therm to the ordinary consumer, with an optional domestic two-part tariff under which gas can be obtained for 3d. per therm *plus* a service charge. The Company's annual output is 320 million cu.ft.

Silica Brick and Salt Attack

By Dr. G. E. FOXWELL

The immunity of silica brick from attack by alkalis during the carbonization of coal, which was first noted by coke oven technologists, is singularly puzzling. Since sodium carbonate, or "fusion mixture," has for years been the recognized reagent for breaking down silicious materials for analysis, it is peculiarly difficult to understand why a brick containing 95% of silica should be more resistant to the action of salt than a brick containing less silica and more alumina. The exact contrary indeed holds for fused alkali carbonates, for in the laboratory it is known that the time required to break down a true silica brick with fused alkali is less than that required for an aluminous brick specimen.

In the April issue of the Transactions of the Ceramic Society, Messrs. F. H. Clews, A. Green, and A. T. Green further discuss this subject in a Paper recording their experiments on the action of potassium chloride vapour on three refractories. The refractories were suspended above the fused salt, the whole operation being conducted in a chamber maintained at 1,000° C. After 160 hours' exposure, 2% of potassium oxide, K_2O, was found to be combined with the silica brick, 7½% with the aluminous clay product, and 11½% with a fireclay product. It may be pointed out that the concentration of alkali in the atmosphere was considerably greater than in carbonizing practice and that water vapour was present only in inconsiderable amounts. Moreover, the temperature of the experiment was such as is only approached by refractories in coke ovens and static gas retorts towards the end of the carbonizing period. Nevertheless, the comparative immunity of the silica brick from attack is confirmed even under these drastic conditions. The Authors point out that for the reaction with alkali chlorides to take place it is necessary for some substance to be present which will provide the potassium with oxygen—*e.g.*, water or an oxidizing agent. As water was absent in these experiments, the necessary oxygen was provided by the air.

Two things are noticeable in these experiments. It has been suggested by W. J. Rees in 1920 and earlier by Professor Cobb in 1916 and in 1918 that this comparative immunity of silica to salt attack is due to the formation of a protective fluid film of silicate glass. With the aluminous bricks, it was suggested that the film was not liquid at the temperature of the experiment, and therefore did not act protectively. The present Authors state, however, that in their experiments, "using dry potassium chloride with negligible access of moisture, there was no appreciable surface glazing action with the silica brick which could protect the underlying material, and very definitely less than occurred with the fireclay brick." It seems likely that the protective film hypothesis cannot be maintained. This will be referred to again later.

Relationship to Carbonizing Practice.

The second noticeable fact is that there was definite evidence of some attack on the silica brick, even though very much less than upon the other bricks. In practice, there is no evidence of attack on silica bricks. The Authors are cautious in applying the results of their experiments to practice, for besides noting the absence of water-vapour in their atmosphere, and recording that the experiments were performed in air and not in a reducing atmosphere, they suggest that possibly the reduced attack of the silica brick was "either due to the greater affinity of clay for potash compared with silica, or else to the greater content of iron oxide, Fe_2O_3, in the fireclay products." If this last explanation should turn out to be the correct one, these experiments cannot be said to have any relationship with carbonizing practice.

Reading this interesting Paper, sent the writer to a dusty cupboard to discover old laboratory records. The following is given under date November, 1919, as some conclusions and thoughts resulting from an investigation upon the subject made nearly 20 years ago. The words are given without alteration, and may prove of interest to those who are investigating this undoubtedly mysterious subject of the immunity of silica brick.

"Very early experiments (these would be about 1913 to 1915) showed that in presence of a stream of HCl-containing gas, iron and aluminium are volatilized from firebrick, but no proof was obtained that this was in any way responsible for firebrick corrosion.

"Potassium chloride has a higher rate of volatilization than sodium chloride, and is approximately double that of sodium chloride at the temperature of the coke oven. Moreover, these are the only volatile salts in coal.

"Kaolin was shown to be attacked by sodium chloride (by fusion with NaCl) forming a salt which contains about 27% of Na_2O. It appears to form the sodium salt of a complex alumino-silicic acid which is a definite chemical compound. This has also been confirmed by other investigators. The sodium cannot be extracted from this material by water.

"There is also a secondary action caused by the hydrochloric acid set free from the sodium chloride which results in the volatilization of a little aluminium chloride. It is, of course, known that clays are acid at high temperatures, and it seems possible that a basic refractory would withstand salt. On the strength of this observation the theory is here formulated that, other things being equal, the resistance of a firebrick to salt varies inversely with its alumina content. This result has been borne out in practice, as the 95% silica brick withstands salt and the 90% claybound brick was found to give way in from 1 to 2 years, while at the same works an 80% silica brick lasted only 7 months. Professor ———— has since informed me that he has independently ascertained that the alumina is the constituent attacked.

"Since silica bricks have been found to withstand salt, it seemed probable that sodium chloride would have no action on silica. This, however, was found to be wrong, as 3 grammes of powdered quartz were entirely converted into sodium silicate (by fusion with NaCl) in 100 hr. It was then thought possible that cristobalite and tridymite might be resistant. This was tried by heating a well-burnt German silica brick with sodium chloride. The result, however, showed that cristobalite and tridymite are as easily attacked as quartz.

"A silica brick which had stood successfully at ———— Coke Works was then analyzed (Note: The analyses are given later—the brick had been in use for three years) with the following results:

Silica—After allowing for the carbon which had entered the face of the brick nearest the oven chamber, there was no variation in the silica content as proceeding from the oven face to the flue face.

Titanium oxide, Magnesium oxide, Alumina } No variation.

Ferric oxide—Slightly more in the centre of the brick than at the oven face.

Lime—More at the inner face of the brick, probably due to the method of manufacture.

Alkalis—Less in centre of brick than at edges. No noticeable increase was observed at the edges.

Suggested Causes of Immunity.

"It was thought that this immunity of the silica brick might be due to:

(1) A film of sodium silicate which subsequently protects the silica from further attack. No appreciable amount of sodium silicate was found, however, and this theory may be regarded as disproved.

(2) The speed of attack at oven temperatures may be only very slow. At, however, 700° to 800° C. we found that quartz and other forms of silica were easily attacked. There does not seem to be much evidence for this hypothesis, though temperature undoubtedly plays an important part in influencing the speed of attack when the brick is of such a nature as to be liable to attack.

(3) Silica bricks contain lime, and the resistance may be due to a film of calcium silicate which encloses the grains of the brick and is immune from attack. No free lime exists in a properly made silica brick. This was proved by digesting the silica brick with nitric acid, when no calcium was brought into solution, whereas when hydrochloric acid was used nearly all the calcium was removed. (Note: This seems a puzzling observation—I wonder if it be accurate!) We did not obtain any direct evidence for this hypothesis." Before this hypothesis could be investigated other work supervened.

In a later report, the details of the analysis referred to are given, with the comment that "experience shows that the bulk analysis of a whole brick is useless when investigating salt corrosion, as the face of an 80% silica brick that is nearest the oven may contain 10% of alkalis,

whereas an inch further into the interior the alkali content may be normal."

—	Original Brick (Average).	Portion Nearest Oven Chamber to a Depth of 0·1 In.	Depth into Brick Measured from Oven Chamber—			Portion Nearest Flue.
			0·1 In.–0·3 In.	0·3 In.–0·7 In.	0·7 In.–1·7 In.	
	%	%	%	%	%	%
SiO_2 .	94·30	90·15	93·46	94·10	94·18	94·30
Al_2O_3 .	2·10	2·07	2·37	2·17	2·23	2·19
Fe_2O_3 .	0·59	0·50	0·50	0·58	0·68	0·50
TiO_4 .	0·24	0·23	0·23	0·25	0·23	0·25
CaO .	1·63	1·95	1·85	1·85	1·65	1·61
MgO.	0·08	0·07	0·08	0·09	0·08	0·08
K_2O .	0·65	0·81	0·78	0·52	0·54	0·76
Na_2O .	0·55	0·43	0·42	0·36	0·53	0·58
Carbon .	..	3·70	0·27	..	..	..

Difficulties of Alkali Determination.

The difficulties of alkali determination 20 years ago when rather less was known about the accuracy of methods than to-day would make it desirable not to draw conclusions concerning the relative amounts of soda and potash present, but to regard the total alkali figure as being the more reliable. It will be observed, therefore, that the face of the brick in contact with the coal charge contained 1·24% of alkali. The section 0·2 in. beneath this face contained 1·2%, while the interior of the brick contained from 0·94% to 1·07%. In the face nearest the flue the alkali content again increased to 1·34%. The conclusion to be drawn from this is that any soluble alkali salts contained in the brick would tend by capillary action to travel towards the face during manufacture in the drying stage, and that no alkali whatever had entered the brick from the coal. This is a remarkable effect in a coke oven which was carbonizing such salty coal that the walls when composed of 80% silica brick had had to be completely rebuilt after only 7 months' operation.

The fact that at this particular plant a 90% clay-bound silica brick stood for a considerably longer period (one to two years) than the 80% silica suggests that the theory of a calcium silicate protective film is not correct, but that the protection is either inherent in any high silica brick or that it is formed after the brick is built into the oven.

It cannot be suggested that the protective film, if any, is due to aluminium silicate, because in the bricks of lower silicate content the aluminium silicate would be the more likely to be formed. In view of these facts the writer is disposed to agree with the Authors of the Paper to which reference was made at the beginning of these notes, that protective film formation is not the reason for the resistance of silica brick to salt attack. At the same time it must be remembered that a very thin film indeed, perhaps in the neighbourhood of only 10 Angstrom units in thickness, proves sufficient to protect metals from corrosion, and it is doubtful whether the presence of so thin a film on the grains of a silica brick could be detected analytically.

These notes are made not in any spirit of criticism of any of the work that has been done, but purely with the idea of making public some ideas and some results obtained a long time ago, which may perhaps be of assistance to those who are investigating this very puzzling phenomenon.

Scottish Junior Gas Association (Eastern District)

Annual General Meeting at Dunfermline

The 33rd Annual General Meeting of the Scottish Junior Gas Association (Eastern District) was held in the Council Chambers, Dunfermline, on Saturday, May 15, Mr. J. M. Dow occupying the chair.

The Council Report showed the strong position of the Association, funds having increased by nearly £40, with a rise in membership of eight.

The average attendance at meetings during the Session was 40, and thanks were expressed to those who had afforded facilities for visits and those who had contributed Papers.

Congratulations were offered to those members who had gained promotion during the year.

The Secretary, Mr. E. W. Alexander, intimated his resignation, and this was accepted with regret. The following Office-bearers were then elected:—

President.—A. C. Rea, Perth.
Vice-President.—R. Cowie, Jun., Hawick.
Hon. Secretary and Treasurer.—T. B. Livingstone, Alloa.
Assistant Secretary and Treasurer.—L. H. W. Locke, Perth.
Council.—James M. Dow, Kirkcaldy (*ex-officio*); Athol Brown, Leven; T. Scott, Leslie; P. Gourlay, Markinch (one year); L. H. W. Locke, Perth (co-opted).
Auditors.—E. L. Farquhar, Kennoway; and M. Darling. Whitburn.

An Address on Refrigeration.

After the conclusion of business, Mr. Dow called upon Mr. Rae, of Electrolux, Ltd., to address the meeting on "Refrigeration." A diagram of the Electrolux system, with sketches of the various types of refrigerators, were distributed to the members, and were of great value in following the lecturer's remarks.

Refrigeration was described as the production of low temperatures, and it was explained how, by reason of the Pure Foods Act, refrigerators had, during the last ten years or so, become essential to the proper handling of all perishable foodstuffs, because, by the passing of this Act, the use of artificial preservatives was greatly curtailed, and, in some cases, eliminated altogether.

After explaining that all refrigerators depended on the physical fact that a liquid, on evaporating, absorbed heat, the speaker traced the development of different types of refrigerators. The chattie, or water jar, with its porous sides, was shown to be an excellent example of how cooling by evaporation could be obtained. The water-ice box and the dry-ice (solid CO_2) box were then described, their advantages and disadvantages being fully explained. This led up to the intermittent absorption type, which is in fairly common use in the East. This consists of two closed vessels connected at their tops by a tube. In one vessel is a mixture of water and ammonia. Heat is applied to this, the resultant vapour passing over to the other vessel which is immersed in water to condense the vapour. After a certain period the heat is withdrawn; the apparatus is then conveyed to the point of use, where the cold vessel is placed among the food requiring cooling.

The compressor or motor-driven type was described, and its many disadvantages stressed. Mr. Rae then came to explain the only gas refrigerator on the market, and, with the aid of a large diagram, outlined the action of this continuous absorption type, showing the many advantages it had over the compressor type, chief of which were the absence of mechanical moving parts, thereby reducing wear-and-tear and the need for service to a minimum, and the absence of all noise when the cabinet was working.

The method of operation employed in the Electrolux gas refrigerator is generally regarded as coming under the classification of an absorption system, but such a description is inadequate in that it overlooks the essential feature of the Electrolux system which distinguishes it from both the purely absorption and the compression systems—that is, the feature which enables it to eliminate all mechanical moving parts.

The inventors have taken advantage of two well-known physical laws: Firstly, that the evaporation of a liquid at a given temperature does not depend on the total pressure existent, but will take place provided that the pressure exerted on the surface of the liquid by its own vapour is sufficiently low; and, secondly, that if there is a mixture of gases in any vessel the total pressure will be the sum of the pressures which would be exerted separately by each of the gases occupying the same vessel alone.

In the Electrolux apparatus the total pressure is practically constant, but in the radiator system (that part of the apparatus in which the evaporation of the refrigerant takes place and cold is produced) another gas—hydrogen—is introduced. This gas produces such a proportion of the total pressure that the remaining portion which is supplied by the refrigerant is sufficiently low to produce evaporation at the low temperatures required. Thus the need for an expansion valve and a compressor is eliminated.

Mr. Rae then pointed out that the gas refrigerator

would provide a valuable gas load if members would realize the position and go out for business before competitors had captured the market. Sales effort was certainly needed, but if the interest of every employee was sufficiently stimulated to sow seeds in the minds of the consumers with whom they were contacting daily, the Gas Industry would obtain a great proportion of this valuable new market which the advent of the domestic refrigerator had opened up. In conclusion, he stated that he believed that the gas refrigerator represented the finest value in domestic refrigeration offered to the public today, and the Gas Industry could go ahead and sell it with confidence, knowing that each sale would bring still another satisfied gas user into the fold.

Mr. Dow thanked Mr. Rae for the way in which he had explained his subject, and assured him of the members' appreciation of his devoting that afternoon to assisting them in their desire to understand the working of the apparatus. In the course of the discussion that followed, Mr. Rea (Perth) asked for information regarding sales of electrical refrigerators by their competitors. He spoke of the success attending cold cookery demonstrations at Perth, and said that it was a specialist's job to sell refrigerators. He thought they were too expensive and alleged that the electrical people offered greater capacity for the same price. Mr. Rae, in reply, quoted figures showing a comparison of sales by the two industries in a certain district. He felt that competitors were more active in their sales campaigns. Sales depended on sales activity—it was necessary to hammer at people. The Gas Industry should certainly employ speciality salesmen for the job. It was difficult to compare electrical and gas refrigerators, as much depended on the quality of materials used and the consequent life of the apparatus. He said that their lowest-priced gas refrigerator was the cheapest on the market.

Mr. Richmond (Penicuik) doubted if Scottish housewives wasted even the small amount estimated by Mr. Rae in working out the approximate cost of running a refrigerator, but Mr. Rae assured him that waste did occur in ordinary housekeeping, and gave examples of instances where a refrigerator would prevent the waste of food.

Penzance Gas Company

Application Under the Gas Undertakings Acts

At the offices of the Board of Trade in London, on Friday, May 28, Mr. JAMES F. RONCA (Director of Gas Administration) held an Enquiry into an application by the Penzance Gas Company, Ltd., for a Special Order under the Gas Undertakings Acts, 1920-1934.

The Company was represented by Mr. Jacques Abady, K.C.; the Penzance Corporation by Mr. R. C. E. Austin (Town Clerk); and the Cornwall County Council by Mr. Gibbon Pritchard (Parliamentary Agent). The opposition of the Cornwall County Council was solely directed to protection with regard to roads and bridges, and quite early in the proceedings an agreement was reached on the few outstanding points, and the opposition of the County Council was withdrawn. It was also agreed to give the Penzance Corporation the same protection as regards roads and bridges. The remaining opposition of the Penzance Corporation was in respect of the proposed basic price and basic dividend as set out in the Draft Order.

Mr. JACQUES ABADY, K.C., stating the case for the Draft Order, said that for the last completed year the sales of gas by the Company amounted to 106 million cu.ft. to which it had grown from 72 million cu.ft. in 1924. The declared quality of the gas was 425 B.Th.U., and the average of the tests carried out during the past twelve months was 428 B.Th.U. The price of gas up to 1929 was 4s. 6d. per 1,000 cu.ft., and this was reduced in 1929 to 4s. 3d. The charge to prepayment meter consumers was 4s. 8d. per 1,000 cu.ft., including meter rent. In March, 1936, in view of the notice which the Company had received from the Board of Trade, a valuation was made of the assets of the Company by Mr. J. W. Buckley, who was well known in connection with the Hornsey Gas Company and was Consulting Engineer and Chairman of the Penzance Company. At the moment, unfortunately, owing to Mr. Buckley's illness he was unable to be present, but his certified valuation was £101,000. Mr. Buckley, as a matter of fact, in consequence of his illness, had retired from the Company. The Engineer to the Company, however, had made a check valuation, and taking land on what was considered to be a conservative basis he arrived at a figure slightly in excess of £101,000. As a result of these valuations the Company doubled the nominal value of its capital from £50,000 to £100,000, at which it stood to-day. That took place in 1936, and prior to that, from 1927 to 1935, a dividend of 8% was paid on the £50,000 capital, free of tax, which was equivalent to 10⅔% in the ordinary way. Last year, although the Company had sufficient funds to declare a dividend on the £100,000 capital equivalent to what it had been paying on the smaller capital, it reduced the dividend slightly to 4½%. The main reason for that was the anticipated expenditure in connection with this capital Order and the change over to a statutory company, but for the purpose of justifying the basic price 13d. per therm, which was in the Order, the accountants to the Company had taken 5% on the capital of £100,000.

Referring to the Draft Order, Mr. Abady said that Clause 4 provided for a considerable extension of the Company's area outside the borough, although it was not pretended that there was likely to be a very big demand all over it as a great deal was agricultural land with very little building development. Under Clause 5, additional share capital was proposed to the extent of £25,000 with borrowing powers of 50% in respect of the total capital of the Company which would then be £125,000. In this way the capital powers of the Company would be increased by £87,500.

By Clause 19 the basic price was fixed at 13d. per therm subject to revision in accordance with the public General Acts. The basic dividend asked for was 5% and the Wrottesley Clause was included in the Draft Order.

Mr. *A. W. White* (Messrs. Cash, Stone, & Co., Chartered Accountants) then gave evidence on behalf of the Company. He said he had gone through the accounts of the Company for the past few years and had adjusted them to bring them more or less into line with the accounts as kept for statutory companies. He confirmed the financial figures given by Mr. Abady and said that for a company making over 100 million cu.ft. per annum, his calculated capital expenditure, on the basis of the valuations which had been mentioned—viz., £1,000 per million, was not unreasonable having regard to the circumstances of the Company. Dealing with the manner in which he had arrived at the basic price of 13d. per 1,000 cu.ft., he said he had projected his mind into the future and foresaw a considerable increase in the price of coal, and he had added 2s. 6d. per ton to the average price now being paid, bringing it up to 35s. per ton delivered. There was not a good market for coke, but instead of the present figure of 37s. per ton he had put it at £2 per ton. At the present moment, however, there was a tendency for the cost of materials to increase in a really alarming manner, and this must be taken into account in estimating the cost of production in the future. He had estimated that there would be an increase of 5% in the wages paid by the Penzance Company in the near future, and it might be more. In suggesting a basic dividend of 5% he had in mind what the Company could have paid last year had it so minded.

Mr. AUSTIN (Town Clerk to the Penzance Corporation) cross-examined Mr. White and challenged the estimates on which the basic price and dividend had been based. He said they were too high having regard to the figures of 1936, but Mr. *White* replied that they took into account the various increases to be anticipated, which he had pointed out, some of which, indeed, were already being experienced.

Mr. AUSTIN then put it to witness that this was not the size of company which should go straight from a non-statutory concern to the latest and most modern form of financial control—viz., the basic price system—and suggested that the sliding scale would be the better form of control to adopt.

Mr. *White* replied that he considered the basic price system would be to the advantage of the consumers.

Mr. AUSTIN then dealt with the point that the capital powers of the Company under this Order would suffice for the next 12 years and contended that, if the basic price system was granted by the Board of Trade, some means should be inserted for revision at the end of, say, five years. He objected to the revision clause in the Gas Undertakings Acts which laid it down that revision could only be applied in exceptional circumstances beyond the control of the Company.

Mr. *White* said he did not think that any such provision for revision was necessary, and he added that the consumers of the Company had been very well treated in the past.

Mr. *G. Stoughton Harris* (Partner in the firm of Messrs. W. B. Keen & Co., Chartered Accountants) said he had advised the Corporation in regard to the Draft Order and considered that the figures of working for 1936 should be taken in arriving at the basic price and the basic dividend. On that basis he contended that a basic price of 11d. per therm and a basic dividend of 4% would be the fair figures to take. He held the view that this was a case where the sliding scale was definitely preferable. On the other hand, if the Company was allowed to be a basic price company, then there should be revision of the basic price at the end of, say, five years, and that could be provided for by a simple alteration in the usual revision clause.

Mr. ABADY cross-examined Mr. Harris, who admitted that in his calculations for the basic price and dividend he had not taken into account any question of increased cost of coal, labour, materials, &c. He said that such opposition as the Corporation had offered to the proposed Order was largely misconceived. Actually, the 5% basic dividend which the Company asked for was something less than had been paid for a great number of years. On the question of the revision of

the basic price, Mr. Abady pointed out that the Gas Charges Committee which had recently reported had not suggested anything in the nature of what was now proposed by the Penzance Corporation. The Company had adopted the Wrottesley Clause, and as the amount of industrial gas sold in this area was negligible he urged that the ordinary consumer would have a protection equivalent to that afforded by the sliding scale.

The DIRECTOR asked Mr. Austin what circumstances he had in mind in asking for revision at the end of five years.

Mr. AUSTIN replied that without some such provision there could only be an application for revision on account of circumstances outside the control of the Company, and in asking for definite revision at the end of five years the Corporation had in mind the possibility of fixing the wrong basic price now, owing to there being, in this case, so many unknown factors.

The Enquiry then closed, Mr. Abady asking that the Board of Trade would make its decision without undue delay as the Company desired to make the change over as soon as possible.

South African Lighting Association, Ltd.

The Forty-Eighth Ordinary General Meeting of the South African Lighting Association, Ltd., was held at the Association's London Offices, 48, Copthall Avenue, E.C. 2, on Wednesday, June 2, 1937—Mr. WILLIAM CASH, J.P., F.C.A. (Chairman of Directors), presiding.

The SECRETARY (Mr. William Cash, Jnr., M.A., F.C.A.) read the notice convening the meeting, together with the minutes of the previous ordinary general meeting, held on June 3, 1936, which were confirmed and signed. He also read the Auditor's report on the Accounts and Balance-Sheet.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN said that it was now his pleasure to move the first resolution—namely, that the Directors' Report and Statement of Accounts for the year ended Dec. 31, 1936, be received and adopted—and he assumed they would take this document as read.

He would like to offer a few observations on the accounts, which were in the form they adopted last year of setting out the revenue and net revenue accounts independently. It was a little disappointing to the Board—and doubtless to the shareholders as well—that the profits for the year 1936 showed a substantial decrease in comparison with those of 1935. This was due to a variety of circumstances. They would see on the right-hand side of the revenue account that the sales of gas were practically the same as a year ago; receipts from rental of meters, stoves, and fittings and profit on fittings sold were down by £200; but the biggest drop was in respect of residuals, which were less by £592. This was partly due to the fact that the quantity of coal carbonized was smaller, so that there was a relatively smaller amount of coke available for sale.

Manufacturing expenses were up by £196, which was not unsatisfactory in view of the fact that coal cost more at both their stations. Distribution expenses were up by £338, due to the fact that they had spent rather more money, particularly at Grahamstown, in overhauling the mains, &c. There were other minor alterations, among which law costs showed a satisfactory decrease in comparison with £94 in the previous year, and the final result was that the total net profit was substantially less than a year ago.

Turning to the net revenue account, Dominion income-tax had fallen by £85, while a year ago they had transferred £500 as a special contribution to the renewal fund; they were not proposing on this occasion to transfer anything further to this fund, to which he would refer later. They had to their credit the results of the sale of some investments; they had been in need of some money during the year and had disposed of a quantity of their War Loan Stock at a profit of £174.

The result of the year's work was indicated in the proposal to carry forward to the year 1937 the sum of £6,985, which compared with £7,228 brought in—or a decrease of £243. After some consideration the Directors felt that, having built up their present position from small dividends which had been gradually rising since 1932, there was no necessity to go back and decrease the dividend if it was only a matter of drawing upon £243 from the carry-forward. They were therefore recommending a dividend at the same rate as last year—namely, 4%.

Sales of Gas.

The sales of gas at Port Elizabeth were about the same as the previous year, while Grahamstown showed an increase of 3%, which was not unsatisfactory. The leakage figure—a matter to which he always drew attention—had gone down satisfactorily at Port Elizabeth to the lowest point for some considerable time; at Grahamstown, unfortunately, the position was reversed, and the leakage figure had gone up. But they were aware of the reason; there had been a big drainage scheme in hand which had interfered with their mains to some extent and caused increased leakage. They had taken the matter up with the authorities, but he was afraid with not much success.

They would be glad to hear that at last there was a move at Port Elizabeth to use gas for industrial purposes, which showed an increase of 3¾%. This was distinctly gratifying. They had, in addition, further applicants for relatively substantial quantities of gas for industrial purposes in that town, where there was a great deal of development going on at the present time. At Grahamstown the position was that the increased sales of gas were due to slot meter consumers and partly to industrial uses also.

They had been adversely affected in regard to the price of coal, which had cost 1s. 9d. per ton more at Port Elizabeth and 1s. 7d. more at Grahamstown—which was reflected to some extent in the revenue account—while labour charges were up as well. It would be appreciated that they had to quote special terms for their industrial consumers, as was done in this country. Provided the supply was available, large quantities of gas could be sold at a lower price because the relative increase in overhead costs was less; therefore, for large quantities they could give special terms, and he was sure it would be agreed that they were doing the right thing in that direction.

Works Improvements.

At both Port Elizabeth and Grahamstown they had spent substantial sums on overhauling their carbonizing plant during the year, as was reflected by the expenditure of £2,678 in the renewal fund; he mentioned this in view of the qualification made in this respect by the Auditor in his report. They had made no addition to this fund during the year, but had spent £2,500 on carbonizing plant renewals, including the totals from both stations. In addition, they had had to carry out further work in connection with their gasholders; there had been work on one of the holders at Grahamstown—but that was not a considerable matter. At Port Elizabeth, however, they had to consider the position, for the largest holder there required some money to be spent on it. They finally came to the conclusion, on the advice of Mr. Woodall and Mr. Terrace, who were well qualified to judge, that the most satisfactory thing to do was to demolish their No. 2 holder of 50,000 cu.ft. capacity and put up in its place a new telescopic holder of 250,000 cu.ft. This would cost a considerable sum of money, though a portion of it was a capital charge by reason of the fact that they would have a larger holder in place of the smaller one. When the new holder was completed—and the construction was now well in hand—they would immediately or in the near future be able to attend to No. 3 holder (previously the largest) in a more satisfactory way than if they had to tackle that one first.

Competition was as keen or keener than ever, but the results for the first three months of the current year, which had just been received, indicated an increase in gas sales at Grahamstown and a small decrease at Port Elizabeth, though it looked as if the latter would be picked up again later. Both towns, and especially Port Elizabeth, were in a prosperous condition industrially, and some of those industrialists were intending to use gas. Their Manager at Grahamstown reported an extending demand for gas, and, what was still more satisfactory, the consumption per consumer was increasing.

In their report two years ago, said the Chairman in conclusion, reference had been made to the retirement of Mr. Sterley after 27 years with the Association, on which occasion appreciation had been expressed of his services and a retiring allowance made to him. He regretted to say that Mr. Sterley passed away on April 26 last, so that he had not long been able to enjoy that pension, and he wished to mention the matter in view of his long and faithful service for them.

The CHAIRMAN then formally moved the resolution for the adoption of the report and accounts, which was seconded by Mr. HENRY WOODALL, J.P., M.Inst.C.E.

Mr. B. W. ELLIS asked whether the Board had considered the question of selling gas refrigerators in South Africa, as was being done in this country. He thought they might be useful in countering electrical competition, though he appreciated that they involved a heavy capital expenditure and not a very large consumption of gas.

The CHAIRMAN agreed that refrigerators were relatively expensive machines by the time the freight and duty had been paid. A number had, however, been sent out to South Africa

and were available in their showrooms. The Board were not overlooking this matter.

Mr. R. W. LONG asked for a further explanation of the Auditor's reference to the adequacy of the renewal fund.

The CHAIRMAN, in reply, said that the Auditor inserted this qualification to protect himself in the sense that he was not in a position to judge whether the renewal fund was adequate or not; he had done so since 1930. It might be, added Mr. Cash, that they would want to strengthen this fund when they hand finished with the gasholder.

The resolution for the adoption of the report and accounts was then put to the meeting and carried unanimously.

Dividends.

The CHAIRMAN thereafter moved that a dividend at the rate of 4% for the year 1936, less income-tax at 3s. 8¼d. in the £, be declared; he added that Dominion income-tax relief was passed on to the shareholder.

The proposition was seconded by Mr. T. N. G. JENNINGS and unanimously agreed.

Re-Election of Director and Auditor.

The CHAIRMAN then moved the re-election to the Board of Mr. Henry Woodall, being the Director retiring by rotation. He need not say anything there about Mr. Woodall's qualifications in connection with the Gas Industry, because everyone in that room and throughout the City of London knew them. They were grateful to him for allowing himself in the midst of his very busy life to be put up for re-election to the Board of their Association.

The proposition was seconded by Mr. J. TERRACE and carried unanimously; and, in acknowledging his re-election, Mr. WOODALL remarked that he had been connected with the Association for many years; he went to South Africa in 1893 in connection with their works, which was quite a long time ago, and he had always taken the greatest possible interest in their affairs and would continue to do so as long as he was connected with them.

It was proposed by Mr. R. W. LONG, seconded by Mr. B. W. ELLIS, and unanimously resolved that the Association's Auditor (Mr. Percival D. Griffiths, F.C.A.) be re-appointed for the ensuing year at the same remuneration as previously—namely, 40 guineas.

Votes of Thanks.

The CHAIRMAN then proposed a cordial vote of thanks to the Officers and staffs of the Association both in South Africa and London. They were very well served by their people, he said, and they were very keen at their work. Their Engineer and Manager in South Africa, Mr. J. H. Goldsmith, went out with a good reputation, and he was working very hard. They would like to be able to reduce the price of gas, and to that end they were striving to raise the consumption so as to spread the use of capital over a larger output. He referred to the work of their Secretary in London and to Mr. Terrace, who also gave an enormous amount of time to their business, writing to South Africa every week; it was of great advantage to have a gentleman of the latter's experience in the Gas Industry to advise them.

The vote of thanks was seconded by Mr. F. R. SMITH, who observed that the accounts and balance-sheet were quite as satisfactory as they could expect in the circumstances; he knew that their new Engineer and Manager in South Africa was working extremely well, while in their Secretary in London and all the staffs they could not be better served.

The SECRETARY (Mr. William Cash, Jnr.), in responding to the vote, said that they did appreciate this expression of thanks, which was in no way a mere formality. And those who appreciated it most were those in South Africa, who were a long way off and did not always find it easy to keep in close touch with them in London. They strove to assist them in this respect by writing to them—as Mr. Terrace did—long letters each week. Nevertheless, those in South Africa were still a long way away, and they liked to feel that once a year they were in the minds of the proprietors, whose dividends were earned by them under the direction of the Board by their day to day work in a sometimes rather trying climate. In conclusion, Mr. Cash added that the proprietors were extremely fortunate in their Board of Directors in London because they were gentlemen who knew how much to leave to those on the spot, while having at the same time a great deal of experience of the Gas Industry.

Finally, a hearty vote of thanks was accorded to the Chairman and Directors on the proposition of Mr. F. R. SMITH, seconded by Mr. W. ARNOTT, in acknowledgment of which Mr. CASH said he was fortunate in his colleagues, who were all specialists. Mr. Jennings had lived in South Africa and was a first-class business man, while his other two colleagues were both well-known in the Gas Industry. He was therefore in a very happy position, and on behalf of the Board he thanked the proprietors very much for their expression of thanks.

The meeting then terminated.

Malta and Mediterranean Gas Company, Ltd.

The Annual General Meeting of the Malta and Mediterranean Gas Company, Ltd., was held on Tuesday, June 1, 1937, at the London Offices of the Company, 5, Great Winchester Street, E.C. 2—Mr. A. M. PADDON, M.Inst.C.E. (Chairman of Directors), presiding.

The SECRETARY (Mr. G. Murray Burton) read the notice convening the meeting, together with the report of the Auditors, and the list of stockholders was duly sealed and signed. The Directors' Report and Statement of Accounts for the year ended March 31, 1937, were taken as read.

THE CHAIRMAN'S ADDRESS.

The CHAIRMAN, in moving the adoption of the report and accounts, observed that it would be idle to pretend that the statement which the Directors had to present to the meeting that day was otherwise than disappointing as compared with the expectations not unreasonably formed twelve months ago.

The causes contributing to this were, as they would realize, entirely beyond their control; national and international circumstances could not be reduced to terms of anticipation. Actually, they had done neither worse nor better than in the previous year. In order to maintain their dividend they took their profits as legitimately supplemented by the interest on investments, because those investments were originally made out of profits. Having done that, they were only a small sum of money short of their objective—between £400 and £500.

The figures in the accounts were so closely similar to those of the previous year that it was hardly worth while drawing attention to them. They had paid a little more for their coal, mainly owing to the fact that they had had to vary the process of gas manufacture by reason of the accumulation of coke—a circumstance which everyone in this country would be very pleased to experience; however, general conditions would doubtless correct the situation in this respect. But when it came to coal they had been very anxious in regard to the threatened stoppage, though what concerned them very much was the increase they would have to pay in freight to Malta; nor could this be evaded, because the matter became more urgent week by week—and stocks had to be replenished.

The whole matter was entirely governed by the disturbed situation in the Mediterranean during recent times. First, the Arabs made trouble at one end; and they had hardly got over that when hostilities commenced in Abyssinia, with all their correlated difficulties; and now there was the trouble in Spain—all round their particular *locale* in the Mediterranean and adversely affecting the Company's position in every way. He did not want to carry this tale of distress too far, for there were extenuating circumstances. Building on the island was progressing; during the past twenty-five years Malta had been more or less stationary, but now, owing to the change in national policy and also to the fact that Malta was becoming attractive to visitors, they were building hotels, hospitals, and houses—which was encouraging. They had just received the results of the first month of the new year, and it recorded a small but nevertheless reassuring increase in business. The Company were prosecuting every measure to enlarge their sales of gas.

A Key Point.

The Government had determined to maintain Malta as a key point in their international policy, which meant that large sums of money were going to be spent there, which would have an indirect effect upon the business on the island. They would have seen the statement made in the House of Commons some months ago which conveyed more than anything he could say in this respect. The prospects were therefore not too bad, although they would have to face a large increase in the price of raw materials. Nor did the price of gas in Malta permit of any considerable extension in business at the present time. The policy of the Company was determined, apart from commercial reasons, by their relations with the Government and national interests out there.

Examination of the balance-sheet showed that they wanted £463 from their carry-forward, which they were well able to

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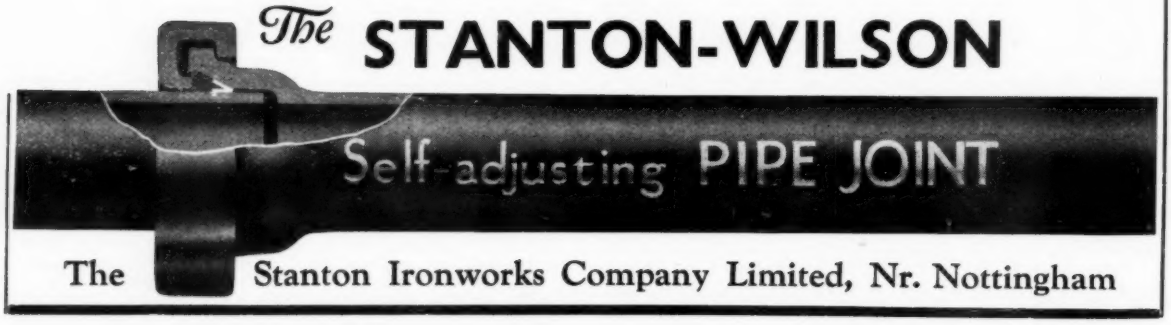

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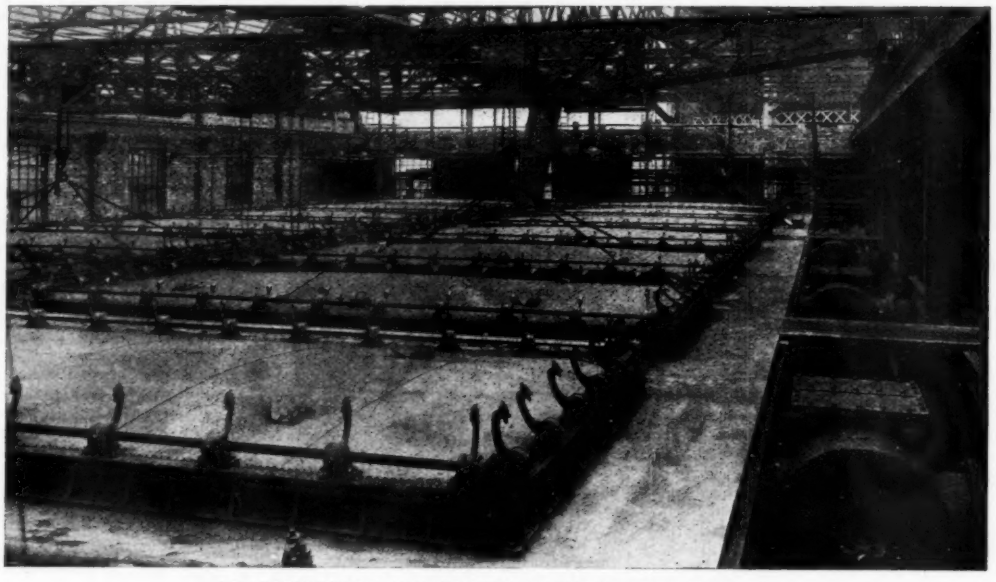

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afford because, after all deductions, it remained at £23,064. Their investments had a book value of £120,443, which, if realized at March 31 last, would have brought in £161,791, and their total capital charge was just over £123,000. The position, therefore, was not desperate, particularly when they remembered that not so many years ago—about fourteen to be exact—they had not a security left which was not lodged with their Bank, and they could not even pay their preference dividend. They had travelled a long way since then, and even if they had some temporary setback the prospects before them—even if more promised than material—were not discouraging.

It would nevertheless be appreciated that paying the large dividend they did, free of income-tax, it must be a matter of consideration to the Directors as to how far it might be necessary to qualify this if the present adverse conditions were maintained. They could only hope for the best and put in what measure of intelligence they possessed; and in so doing they hoped that things would not be too bad, while at the same time there was no reason to assume that they would be any better.

The CHAIRMAN then formally moved the resolution for the adoption of the report and accounts, which was seconded by Mr. A. W. OKE, B.A., LL.M., and carried unanimously.

Dividends.

The CHAIRMAN thereafter moved:

> That final dividends at the full rates be declared on the first and second preference stock and a dividend of 5% (free of income-tax) on the ordinary stock, making for the year (with the interim dividends paid in December last) a total distribution of 7% on the first preference stock, 7½% on the second preference stock, and 10% (free of income-tax) on the ordinary stock.

The resolution was seconded by Mr. E. L. BURTON, F.S.A.A., and carried unanimously.

Re-Election of Directors and Auditors.

The retiring Director (Mr. A. W. Oke) was re-elected, and the Auditors (Mr. William Cash, F.C.A., and Mr. Hyde Clarke Burton, F.C.A.) were duly re-appointed.

The proceedings then closed with a vote of thanks to the Chairman and Directors and to the staffs at London and Malta.

Trade Notes

Dussek Bitumen & Taroleum, Ltd.

This firm has moved to new Head Offices at Empress Wharf, Bromley-by-Bow, London, E. 3 ('phone: ADVance 4127).

Thermocontrol Installations Company, Ltd.

The above firm announce that on and after June 1, 1937, their address will be: 68, Victoria Street, S.W. 1; Telephone: Victoria 9719.

Gasholder Inspection.

Mr. Leonard Bott, Independent Gasholder Inspector, of Rosslyn, Crewe Road, Alsager, Stoke-on-Trent, has been engaged periodically to examine and report upon all the gasholders, at present totalling sixty-two, controlled by Associated Gas and Water Undertakings, Ltd.

Gas at Agricultural Show.

Continuing their policy of the past four years, Messrs. R. Russell & Sons, Ltd., Peel Foundry, Derby, are again this season making a comprehensive exhibit of their "New Herald" cookers, "Peveril" fires, and gas combinations at the more important agricultural shows throughout the country. Where gas is available at the showground the "New Herald" gas combination complete with hot water circulating system is in action.

From Cairo to the Cape.

From Cairo to the Cape, Messrs. Head, Wrightson, & Co., Ltd., Thornaby-on-Tees, Stockton-on Tees, London, and Johannesburg, have left a lasting impression of engineering enterprise and achievement. Bridges, gold mining equipment, headgears, floating docks, power stations, all have the same nameplate. Fine photographs produced in an attractive folder recently issued by the firm were all secured during a 23,000 mile tour of Africa by Mr. John Wrightson.

Whessoe Woodall-Duckham Electro-Detarrer.

The Whessoe Foundry and Engineering Company, Ltd., Gas Treating Plant Makers, Darlington, have issued an illustrated booklet giving some details of recent installations of the Whessoe Woodall-Duckham Electro-Detarrer. From this we learn the orders for W. W.-D. detarrers in 1932-33 represented a total daily capacity of 8 million cu.ft., but in 1936-37 this figure had increased 102 million cu.ft. During the same period the number of plants ordered per annum had risen from one to ten. The aggregate capacity of plants installed in all parts of the world is over 243 million cu.ft. per diem.

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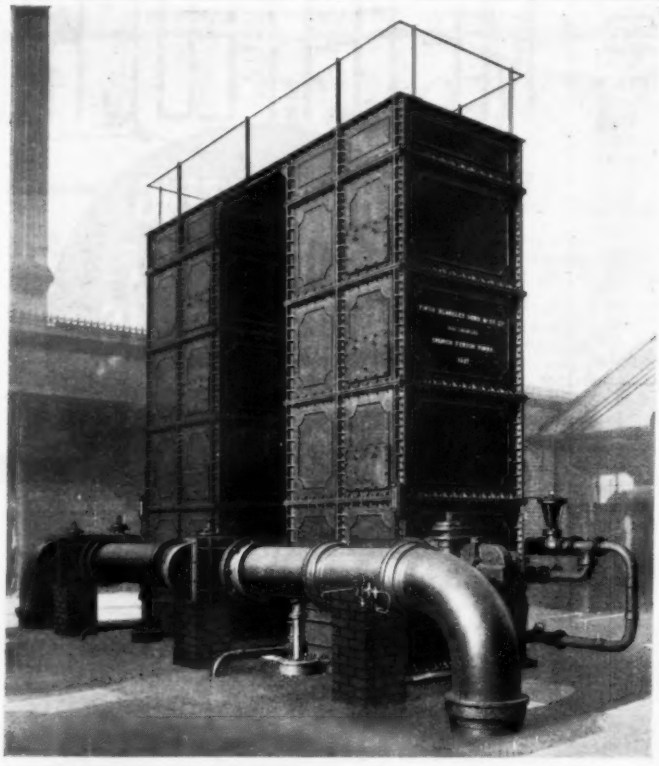

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Gas Markets and Manufactures

Stock Market Report

(For Stock and Share Lists, see later pages)

After the Prime Minister's withdrawal of the unpopular N.D.C., conditions on the Stock Exchange became much brighter last week, and with Derby day out of the way it really looked as if the House would be in for a busy time. Unfortunately a "gold scare" revival came into being, and markets quickly presented a dull and uncertain appearance. Gold shares were promptly marked down and prices in many other sections suffered accordingly. The present reactions, however, are not comparable with those of a few weeks ago when values declined rapidly in consequence of the speculative position. The general undertone is one of confidence, and that markets are ripe for a revival is evidenced by the large over-subscription to the West Riding County Council's issue of 3½% stock at 100½, now being dealt in at ¼ premium. There are many good bargains obtainable at the present low prices, and a return to more active conditions is anticipated during the current week.

Despite, or perhaps because of, the general dulness elsewhere the Gas Market was quite well supported and values on the whole were maintained, the prices of recorded transactions showing little change either way over those of a week ago. Gas Light units reacted slightly in sympathy with the Gilt-edged market and closed 3d. lower at 25s. 6d., and Imperial Continental dropped 4 points to 155½. On the other hand, however, both Croydon sliding-scale stock and Bournemouth 4% debenture hardened a point. At the Provincial Exchanges, the only alteration of note was a shortening of the margin in Derby Consolidated from 20 to 10 points, thus bringing the quotation more in accord with present conditions. In the Supplementary List several parcels of Hampton Court consolidated changed hands at higher prices and the nominal quotation was moved up 5 points to 157½.

Of interest this week to "gas" investors was the issue made yesterday by the United Kingdom Gas Corporation, Ltd., of 500,000 4% 1st redeemable preference shares of £1 each at par.

Current Sales of Gas Products

The London Market for Tar Products.

LONDON, *June 7.*

There is little of interest to record in the Tar Products market, to-day's prices being as follows:

Pitch, 36s. to 37s. per ton f.o.b.
Creosote, 6d. to 6¼d.
Refined tar, 3¾d.
Pure toluole, 2s. 6d.; pure benzole, 1s. 9d.; 95/160 solvent naphtha, about 1s. 8d.; and 90/160 pyridine, about 8s.; all per gallon naked at makers' works.

Tar Products in the Provinces.

June 7.

The average prices of gas-works products during the week were: Gas-works tar, 22s. 6d. to 27s. 6d. Pitch—East Coast, 35s. to 36s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 35s. to 36s.* Toluole, naked, North, 2s. to 2s. 1d. Coal tar crude naphtha, in bulk, North, 8½d. to 9d. Solvent naphtha, naked, North, 1s. 6¼d. to 1s. 6½d. Heavy naphtha, North, 1s. 3d. to 1s. 3½d. Creosote, *ex* works, in bulk, North, liquid and salty, 5d. to 5½d.; low gravity, 4⅝d. to 4½d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid 60's, 3s. 7½d. to 3s. 10½d. Naphthalene, £18 to £20. Salts, 90s. to 95s., bags included. Anthracene "A" quality, 4½d. to 4⅝d. per minimum 40% purely nominal; "B" quality, unsalable.

N.B.—In last week's issue the price of carbolic acid 60's was erroneously given as 2s. 7½d. to 2s. 10½d. The price should have read 3s. 7½d. to 3s. 10½d.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *June 5.*

Prices are well maintained in all departments and business is somewhat restricted for want of prompt supplies.

Crude gas-works tar.—The actual value is 37s. to 38s. per ton *ex* works in bulk.

Pitch.—Little interest is being taken with prices unchanged at 30s. to 32s. 6d. per ton f.o.b. Glasgow for export, and 30s. per ton *ex* works in bulk for home trade.

Refined tar.—Makers are quoting freely at about 3d. to 3½d. per gallon free on rails for export and 3½d. to 3¾d. per gallon *ex* works in buyers' packages for home trade.

Creosote oil.—The market is very steady with values not lower than the following: Specification oil, 5½d. to 5¾d. per gallon; low gravity, 5¾d. to 6d. per gallon; neutral oil, 5¼d. to 5½d. per gallon; all *ex* works in bulk.

Cresylic acid.—Profit taking is having its effect on prices, but values can still be taken as under: Pale, 97/99%, 4s. 5d. to 4s. 7d. per gallon; dark, 97/99%, 4s. 2d. to 4s. 4d. per gallon; and pale, 99/100%, 4s. 10d. to 5s. 1d. per gallon; all *ex* works in buyers' packages.

Crude naphtha is in steady call at 6d. to 6¼d. per gallon *ex* works in bulk, according to quality and district.

Solvent naphtha.—90/160 grade is 1s. 4¼d. to 1s. 5½d. per gallon, and 90/190 heavy naphtha is 11d. to 1s. per gallon.

Motor benzole remains at 1s. 4d. to 1s. 4½d. per gallon.

Pyridine.—Prices are nominal at 7s. to 8s. per gallon for 90/160 grade, and 8s. to 9s. per gallon for 90/140 grade.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	10	to	0	10½	per gallon at works
Motor "	1	3¾	"	1	4	" " "
90% "	1	4¾	"	1	5	" " "
Pure "	1	8¾	"	1	9	" " "

Contracts Advertised To-Day

C.I. Mains and Connections.

Sidmouth Gas Department. [p. 818.]

Coal.

Clitheroe Gas Department. [p. 818.]
Shipley Gas Department. [p. 818.]

Coke Storage Hopper.

Cowes Gas Department. [p. 818.]

Compressor.

Newbury Gas Department. [p. 818.]

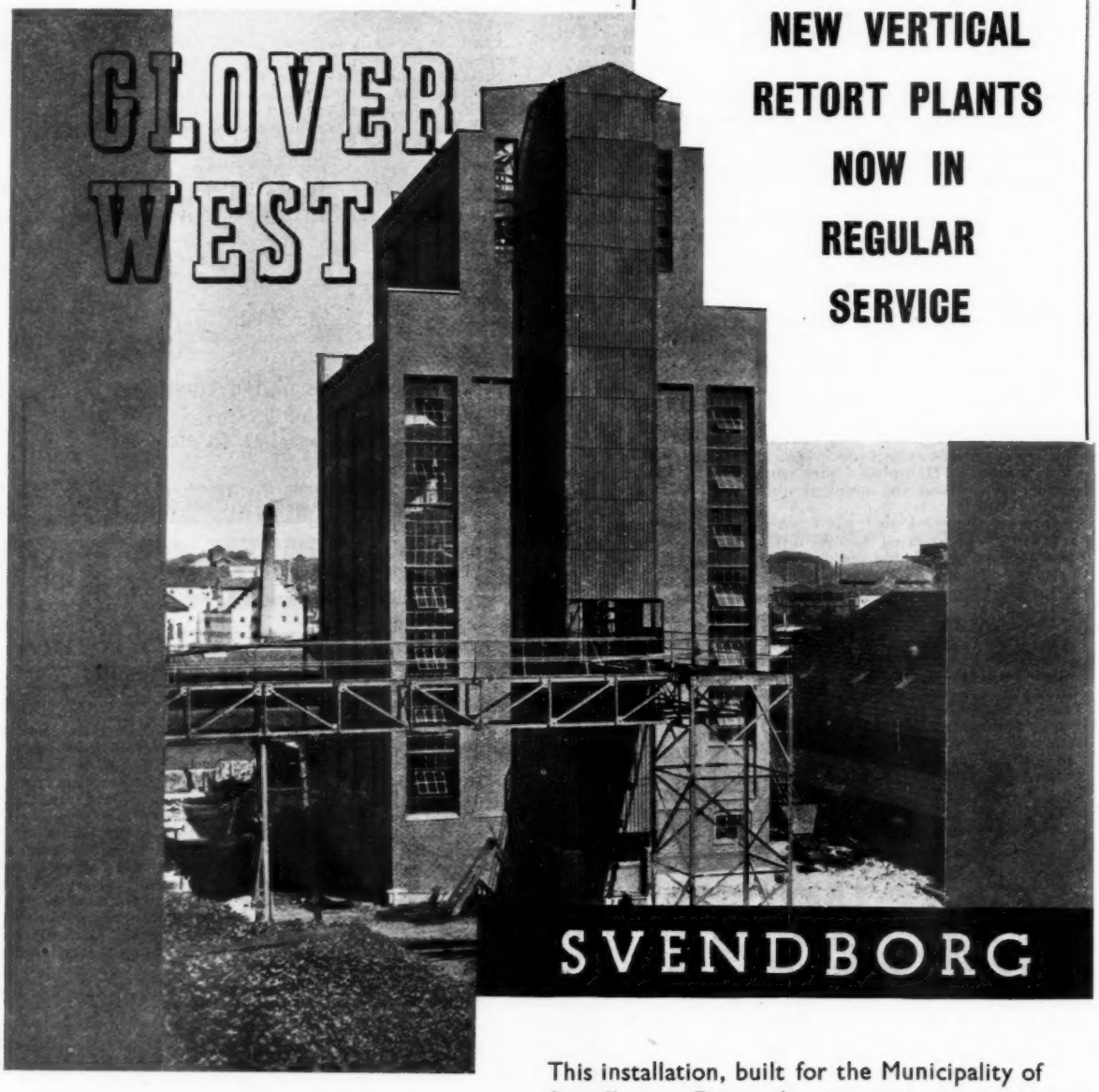
Gas Undertakings' Results

Bideford.

The report of the Directors of the Bideford Gas and Coke Company states the profit for the year is £5,617, which, added to the amount brought forward of £2,078, makes a total of £7,695. After providing for interest on debentures, accrued preference dividend, interest charges, and the outstanding balance of the cost of the 1932 Order, there remains a balance available for distribution of £3,967. The Directors at the annual meeting recommended the payment of a final dividend of 8% on the "original" shares and 6½% on the "additional" shares, making for the whole year: 14½% per annum on the "original" shares; 11½% per annum on the "additional" shares; together with a transfer of £150 to Pension Reserve. These payments will absorb the sum of £2,132, leaving to be carried forward to next year's account, £1,835. The sale of gas shows a satisfactory increase of 4·17%.

Darwen.

The annual report of the Darwen Gas Department states that for the year ended March 31, 1937, the net profit of £6,956 is £611 in excess of last year and constitutes a record for the undertaking. The voluntary increase of 1s. per ton has been continued throughout the year on existing coal contracts. The expenditure on coal on this account and the fact that more coal has been carbonized, is in excess of last year by £781, part of which has, of course, been retrieved by increased revenue from residuals. Over 189 million cu.ft. of gas were made from 9,756 tons of coal, equivalent to 19,467 cu.ft. per ton; this is less than last year by 1,580,000 cu.ft., and can be explained by "slow" registration of the station meter until it was repaired. The gas sold as registered by consumers' meters was 177,026,800 cu.ft., an increase of 5,970,500 cu.ft. over the previous year. Unaccounted-for gas shows a big reduction, which on reflection is not so much, because slow registration of the station meter does not give full credit for the quantity of gas made, thereby reducing the manufacturing results, and increasing the quantity of coal used. Over 12 million cu.ft. of gas were unaccounted-for compared with 20,397,700 cu.ft. last year. Although nearly 6 million cu.ft. more gas were sold, the receipts for gas were reduced by £179. This is accounted for by a modification of gas charges to larger consumers and the effect of a two-part tariff rate to other consumers. The progressive sales policy was continued through the showroom and on the district, as is reflected by an increase in sales of appliances by £2,147, that is £6,310 in 1936-1937 and £4,163 in 1935-1936. The credit balance at the beginning of the year was £8,174, in addition to £5,000 in reserve fund. After contributing £2,000 to the relief of rates the year ended with a balance in hand of £13,129 and £5,193 in reserve fund.



400 plants in 24 countries

This installation, built for the Municipality of Svendborg, Denmark, is an interesting example of the modern Glover-West vertical retort plant designed for the smaller works. It is an eight-retort unit with fuel-gas producers equipped for breeze-burning, waste-heat recovery plant and electric lift. Coaling is by means of an automatic skip-hoist.

WEST'S GAS IMPROVEMENT CO., LTD.

MANCHESTER: ALBION IRONWORKS, MILES PLATTING ■ **LONDON:** COLUMBIA HOUSE, ALDWYCH, W.C. 2

STOCK AND SHARE LIST

Official Quotations on the London Stock Exchange

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations June 4.	Rise or Fall on Week.	Transactions, Lowest and Highest Prices During the Week.
1,767,439	Stk.	Mar. 15	8	8	Alliance & Dublin Ord. ...	170—175	...	...
374,000	,,	Dec. 14	4	4	Do. 4 p.c. Deb. ...	96—101	...	...
558,890	,,	Feb. 15	7	7	Barnet Ord. 7 p.c.	160—165	...	...
300,000	1	Apl. 5	1/4⅛	1/9⅜	Bombay, Ltd.	25/6—27/6	...	...
179,915	Stk.	Mar. 1	9½	9½	Bournemouth sliding scale ...	195—205	...	...
590,407	,,	,,	7	-	Do. 7 p.c. max. ...	161—166	...	...
493,960	,,	,,	5	6	Do. 6 p.c. Pref. ...	133—138	...	133—135
50,000	,,	Dec. 14	3	3	Do. 3 p.c. Deb. ...	80—85	...	...
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	118—123	+1	122½
357,900	,,	Feb. 15	7½	7½	Brighton, &c., 6 p.c. Con. ...	155—160	...	157½
649,955	,,	,,	6⅜	6¾	Do. 5 p.c. Con. ...	138—143	...	...
205,500	,,	,,	6	6	Do. 6 p.c. 'B' Pref.	130—135	...	...
855,000	,,	Mar. 1	7	8	British Ord.	148—153	...	...
100,000	,,	Dec. 14	7	7	Do. 7 p.c. Pref.	143—148	...	...
350,000	,,	,,	5½	5½	Do. 5½ p.c. 'B' Cum. Pref.	110—115	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	103—108	...	...
450,000	,,	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	1—3	...	...
100,000	10	6 Nov. '33	4½	4½	Do. 4½ p.c. Pref. ...	1⅛—3¼	...	40/-
150,000	Stk.	Jan. 4	4½	4½	Do. 4½ p.c. Deb. ...	80—85	...	...
626,860	,,	Feb. 1	6	6	Cardiff Con. Ord.	120—125	...	...
237,860	,,	Dec. 14	5	5	Do. 5 p.c. Red. Deb.	107—112	...	...
98,936	1	Apl. 5	2/-	2/-	Colombo Ord.	1⅞—1⅞	...	...
24,510	1	,,	1/4½	1/4½	Do. 7 p.c. Pref. ...	23/—25/-	...	...
739,453	1	Mar. 15	-/11·48	-/11·48	Colonial Gas Assn. Ltd. Ord.	17/—19/-	...	...
296,144	1	,,	1/3·30	1/3·30	Do. 8 p.c. Pref.	22/—24/-	...	...
1,775,005	Stk.	Feb. 1	5	5	Commercial Ord.	88—93	...	93
620,000	,,	Nov. 30	3	3	Do. 3 p.c. Deb. ...	73—78	...	...
286,344	,,	Feb. 15	5	5	Do. 5 p.c. Deb. ...	115—120	...	116—117½
807,560	,,	Feb. 15	7	7	Croydon sliding scale ...	143—148	+1	147—147½
644,590	,,	,,	6	5	Do. max. div.	109—114	...	112
620,385	,,	Dec. 14	5	5	Do. 5 p.c. Deb.... ...	115—120	...	...
239,000	,,	Feb. 1	5	5	East Hull Ord. 5 p.c.... ...	100—105	...	102½
185,355	,,	Feb. 15	6	6	East Surrey Ord. 5 p.c. ...	122—127	...	...
176,211	,,	Dec. 14	5	5	Do. 5 p.c. Deb. ...	113—118	...	...
250,000	1	Nov. 16	6	4	Gas Consolidation Ord. ...	20/—22/-	...	...
250,000	1	May 24	4	4	Do. 4 p.c. Red Cum. Pref.	19/—21/-*	...	19/9
19,255,284	Stk.	Feb. 1	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	25/—26/-a	-/3	25/1½—25/8¼
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	80—83	...	81½
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	100—103	...	101—103
8,602,497	,,	May 24	3	3	Do. 3 p.c. Con. Deb. ...	80—83*	...	81½—83
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	109—113*	...	113
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb....	108—111*	...	110—111
700,000	,,	Mar. 1	25/5⅜	3¼	Do. 3½ p.c. Red. Deb....	98—101	...	100—100½
270,466	,,	Feb. 15	6	6	Harrogate New Cons. ...	122—127	...	...
213,200	,,	Feb. 15	6	6	Hornsey Con. 3½ p.c. ...	120—125	...	...
5,600,000	,,	May 24	8	12	Imperial Continental Cap. ...	153—158*	−4	153½—158½
223,130	,,	Feb. 1	3½	3½	Do. 3½ p.c. Red. Deb. ...	90—95	...	...
285,242	,,	Mar. 1	8½	8½	Lea Bridge 5 p.c. Ord. ...	160—165	...	...
11,751	,,	Mar. 1	8	10	Maidstone Gas 5 p.c. Cap. Stk.	180—190	...	...
63,480	,,	Dec. 14	3	3	Do. 3 p.c.Prp.Db.Sk.	72—77	...	...
75,000	,,	May 24	†10	†10	Malta & Mediterranean ...	150—160*	...	...
392,000	—	Apl. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98—103	...	...
231,978	Stk.	Feb. 15	5	5	M.S. Utility 'C' Cons. ...	102—107	...	...
968,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	95—100	...	97½—99
360,075	,,	Dec 14	4	4	Do. 4 p.c. Deb. ...	97—102	...	99¾—100
148,955	,,	,,	5	†5	Do. 5 p.c. Deb. ...	115—120	...	...
125,000	—	Jan. 4	3½	3½	Do. 3½ p.c. Rd.Rg.Bds.	97—100	...	...
675,000	Stk.	May 3	†6	†9	Montevideo, Ltd.	85—90	...	87—89
250,000	,,	Feb. 15	7½	7½	North Middlesex 6 p.c. Con.	152—157	...	...
396,160	,,	Feb. 1	5	5	Northampton 5 p.c. max. ...	102—107	...	...
300,000	,,	Apl. 19	†9	†7	Oriental, Ltd....	162—167	...	...
416,617	,,	Dec. 14	8	8	Plymouth & Stonehouse 5 p.c.	165—170	...	165
621,667	,,	Feb. 15	8½	8½	Portsmouth & Gosport Cons.	167—172	...	...
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	105—110	...	...
73,350	,,	,,	...	5	Do. 5 p.c. Pref. ...	112—117	...	...
441,275	1	May 3	1/-	1/1½	Severn Val. Gas Cor. Ld. Ord.	21/—23/-	...	22/—22/6
460,810	1	Mar. 15	-/10½	-/10½	,, ,, 4½ p.c. Cum. Pref.	20/—22/-	...	...
133,201	Stk.	Feb. 15	5	8½	Shrewsbury 5 p.c. Ord. ...	140—145	...	...
90,000	10	June 8	‡3½	‡4	South African...	4—5	...	...
1,371,752	1	May 3	1/2⅞	1/2⅞	South East'n Gas. Cn.Ld. Ord.	24-/—26/-	...	...
871,636	1	Mar. 1	-/10½	-/10½	Do. 4½ p.c. Red. Cum. Pref.	20/—22/-	...	21/7½
498,818	1	,,	4	4	Do. 4 p.c. Cum. Pref. ...	19/6—21/6	...	20/-
450,000	,	Feb. 15	4	4	Do. 4 p.c. Deb.	100—102	...	...
150,000	Stk.	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	99—101	...	...
6,709,895	,,	Feb. 1	5	6	South Met. Ord.	107—110	...	108—109½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf. ...	132—137	...	132
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf. ...	97—100	...	99—100
1,895,445	,,	Dec. 14	3	3	Do. 3 p.c. Deb. ...	75—80	...	80⅞
1,000,000	,,	Jan. 4	5	5	Do. 5 p.c. Red. Deb....	107—112	...	111—112
1,543,795	,,	Feb. 1	6	6	South Suburban Ord. 5 p.c....	122—127	...	124
512,825	,,	,,	5	5	Do. 5 p.c. Pref....	112—117	...	...
500,000	,,	,,	4	4	Do. 4 p.c. Pref....	95—100	...	...
888,587	,,	Dec. 14	5	5	Do. 5 p.c. Deb....	115—120	...	117½
250,000	,,	,,	4	4	Do. 4 p.c. Deb....	98—103	...	...
427,859	1	May 3	9⅜	1/2⅜	S. Western Gas & Water Ord.	19/—21/-	...	20/-
160,523	1	Apl. 19	-/10⅜	-/10⅜	Do. 4½ p.c. Red. Cum. Pf.	20/—22/-	...	20/6
110,000	Stk.	Dec. 14	4	4	Do. 4 p.c. Red. Deb. ...	98—103	...	...
750,541	,,	Feb. 1	5	5⅛	Southampton Ord. 5 p.c. ...	111—116	...	116
148,836	,,	Jan. 4	4	4	Do. 4 p.c. Deb.	98—103	...	...
350,000	,,	Feb. 15	5⅛	5⅛	Swansea 5½ p.c. Red. Pref. ...	110—115	...	...
106,000	,,	Jan. 4	6½	6½	Do. 6½ p.c. Red. Deb. ...	98—101	...	...
94,000	,,	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...	...
1,076,490	,,	Feb. 15	6⅝	6⅝	Tottenham and District Ord.	137—142	...	140
409,835	,,	,,	5½	5½	Do. 5½ p.c. Pref....	123—128	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	...
371,850	,,	Nov. 30	4	4	Do. 4 p.c. Deb. ...	98—103	...	...
373,939	,,	Feb. 15	7	7	Uxbridge, &c., 5 p.c. ...	142—147	...	...
133,010	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	111½
1,371,138	,,	Feb. 1	7	7	Wandsworth Consolidated ...	143—148	...	145—147
1,620,615	,,	,,	5	5	Do. 5 p.c. Pref ...	113—118	...	115
500,000	,,	,,	33/4	4	Do. 4 p.c. Pref. ...	95—100	...	...
1,343,964	,,	Dec. 14	5	5	Do. 5 p.c. Deb. ...	117—122	...	118½—120½
383,745	,,	,,	4	4	Do. 4 p.c. Deb. ...	98—103	...	102
558,342	,,	Feb. 1	7	7	Watford and St. Albans Ord.	142—147	...	...
200,000	,,	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...	...
200,000	,,	,,	5⅛	5⅛	Do. 5⅛ p.c. Pref. ...	123—128	...	...
200,000	,,	Dec. 14	4	4	Do. 4 p.c. Red. Deb.	97—102	...	...
100,000	,,		3⅛	3⅛	Do. 3⅛ p.c. Red.Deb.	95—100	...	...

a.—The quotation is per £1 of Stock. * Ex div. † Paid free of income-tax. ‡ For year. § Actual.

Stock and Share List continued overleaf.

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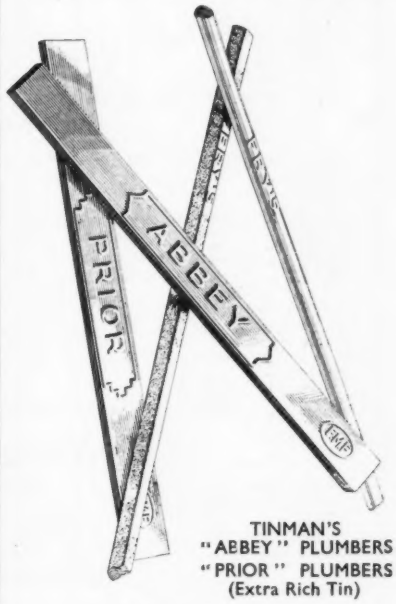
SOLDERS
& FLUXES



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"ABBEY" PLUMBERS
"PRIOR" PLUMBERS
(Extra Rich Tin)

"FRYSOL" PASTE FLUX

"FRYSOL"
TINNING SALT

Write to-day for samples and quotations
FRY'S METAL FOUNDRIES LTD.
Tandem Works, Merton Abbey, S.W. 19
MITcham 4023

STOCK AND SHARE LIST—Cont.

Stocks Officially Quoted on Provincial Exchanges

Issue. £	Stock or Share	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. June 4.	Rise or Fall on Week.	Transactions, Lowest and Highest During the Week.
BRISTOL EXCHANGE.								
347,756	Stk.	Feb. 1	5	6	Bath Cons.	121—123	...	...
1,667,250	,,	Feb. 15	5	5	Bristol, 5 p.c. max.	116—117	...	...
120,420	,,	Dec. 14	4	4	Do. 1st 4 p.c. Deb. ...	102—104	+1	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	102—104	+1	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	122—125	...	...
274,000	,,	Mar.	5	5	Newport (Mon.) 5 p.c.max. ...	103—108	...	...
13,200	12	Mar. 15	7	8	Pontyp'l Gas & W. 10 p.c. 'A'	13½—14½	...	...
13,600	10	,,	5	6	Do. 7 p.c. 'B'	12—12½	...	...
40,000	10	,,	5	6	Do. 7 p.c. 'C'	12—12½	...	...
140,778	Stk.	Feb. 1	5	5	Weston-super-Mare Cons. ...	112—113	...	...
64,338	,,	Dec. 14	4	4	Do. 4 p.c. Deb.	98—101	...	...
33,340	,,	,,	7½	7½	Do. 7½ p.c. Deb.	160—163	...	...
LIVERPOOL EXCHANGE.								
157,150	Stk.	Feb. 1	5	6½	Chester 5 p.c. Ord.	106—111	...	...
92,500	,,	Dec. 14	4½	4	Do. 4 p.c. Pref.	98—102	...	...
36,430	,,	,,	3	3½	Do. 3½ p.c. Deb....	90—95	...	...
41,890	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	99—103	...	...
2,167,410	,,	Feb. 15	6	6	Liverpool 5 p.c. Ord. ...	125½—127½	...	...
245,500	,,	Dec. 14	5	5	Do. 5 p.c. Red. Pref. ...	101—106	...	...
306,083	,,	Jan. 4	4	4	Do. 4 p.c. Deb. ...	103—105	...	...
106,280	,,	Feb. 1	10	10	Preston 'A' 10 p.c.	210—220	...	...
188,219	,,	,,	7	7	Do. 'B' 7 p.c.	150—160	...	...
NEWCASTLE EXCHANGE.								
122,577	Stk.	Feb. 1	8	8	Blyth 5 p.c. Ord.	166—168	...	...
732,000	,,	Feb. 15	5	5	Hartlepool G. & W. Cn. & Nev	124—126	...	...
2,061,315	,,	Feb. 1	5	5½	Newcastle & Gateshead Con.	25/3—25.9a	...	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	100—101	−½	...
776,706	,,	Jan. 4	3½	3½	Do. 3½ p.c. Deb. ...	93—94	...	...
277,285	,,	Nov. 2	5	5	Do. 5 p.c. Deb. '43...	108—109	...	...
332,351	,,	Feb. 1	6	6	Sunderland 6 p.c. max. ...	139—141	...	...
NOTTINGHAM EXCHANGE.								
542,270	Stk.	Mar. 1	7	9	Derby Con.	155—165	−5	...
55,000	,,	Dec. 14	4	4	Do. 4 p.c. Deb.	100—105	...	...
84,750	,,	Feb. 17	5	12	Long Eaton 'A' Ord. ...	...	...	...
50,000	,,	,,	4	10	Do. 'B' Ord. ...	...	...	...
20,000	10	Dec. 14	5	5	Do. 5 p.c. Pref. ...	10—12	...	...
80,000	Stk.	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...	...
SHEFFIELD EXCHANGE.								
10,000	Stk.	Aug. 10	10	10	Great Grimsby 'A' Ord. ...	210—220	...	...
6,500	,,	,,	10	10	Do. 'B' Ord. ...	210—220	...	...
79,000	,,	,,	10	10	Do. 'C' Ord. ...	205—210	...	...
1,806,339	,,	Feb. 15	6	6½	Sheffield Cons.	144—146	...	...
95,000	,,	Jan. 4	4	4	Do. 4 p.c. Deb.	101—104	...	...

Supplementary List of Stocks and Shares not Officially Quoted

202,152	Stk.	Mar. 15	25/-b	25/-b	Ascot Ord.	102—107	...	...
128,182	,,	Jan. 4	5	5	Do. 5 p.c. Pref.	110—115	...	...
312,083	1	May 24	5	5	Assd. Gas and Water Ord. ...	19/6—21/6*	...	...
326,071	1	,,	4½	4½	Do. 4½ p.c. Cum. Pref. ...	19/6—21/6*	...	20/—20/6
150,000	Stk.	Mar. 15	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...	97¼—97¾
17,000	,,	Feb. 15	8	8	Bognor Orig. Ord. 'A' ...	160—170	...	...
62,210	,,	,,	8	8	Do. New Addl. 'A' ...	160—170	...	...
87,160	,,	,,	7	7	Do. New 7 p.c. max. ...	140—145	...	...
37,440	,,	Feb. 1	10	10	Cam. Univ. & Town 10 p.c.max.	195—205	...	...
125,970	,,	,,	7	7	Do. 7 p.c. max.	137—142	...	...
39,025	,,	,,	5	5	Do. 5 p.c. max.	98—103	...	...
65,000	,,	Mar. 1	7½	8½	Eastbourne 'A' 5 p.c. ...	160—165	...	...
198,000	,,	,,	6	7	Do. 'B' 3½ p.c.	130—140	...	...
112,312	,,	,,	5	5½	Do. 5 p.c. Pref.	110—115	...	...
130,000	,,	Dec. 14	5	5½	Do. 5 p.c. Deb.	115—120	...	...
24,000	30	Feb. 1	8½	8½	Great Yarmouth 8½ p.c. max.	45—50	...	...
59,400	30	,,	7½	7½	Do. 7½ p.c. max.	40—45	...	...
51,160	Stk.	Dec. 14	5½	5½	Do. 5½ p.c. Deb.	122—127	...	...
152,600	,,	Feb. 15	8	9	Guildford Cons.	190—200	...	...
54,055	,,	,,	5	5	Do. 5 p.c. Pref.	112—117	...	...
68,250	,,	Dec. 14	5	5	Do. 5 p.c. Deb.	115—120	...	...
156,600	,,	Feb. 15	7½	7½	Hampton Court Cons. ...	155—160	+5	159½—160
107,960	10	Mar. 15	4	5½	Mid Kent Ord.	9—10	...	...
230,940	Stk.	Feb. 15	10	10	Oxford & District Ord. ...	200—210	...	...
47,112	,,	,,	5	5	Do. 5 p.c. Pref.	110—115	...	...
50,000	,,	,,	6	6	Do. 6 p.c. Red. Pref. ...	112—117	...	...
126,193	,,	May 3	7½	7½	Peterborough Ord.	159—165*	...	...
64,990	,,	Mar. 15	6½	7½	Redditch Ord.	127—137	...	...
166,850	,,	Feb. 15	8	8	Romford Ord.	157—167	...	...
60,000	,,	,,	4	4	Do. 4 p.c. Pref.	97—100	...	...
44,000	,,	Mar. 15	5	5	Do. 5 p.c. Deb.	115—120	...	...
10,950	,,	Mar. 1	8	8	Ryde Ord.	160—165	...	...
136,191	,,	Feb. 15	5	7	Scarborough Ord.	123—133	...	...
27,825	,,	Feb. 1	8	8	Shanklin & Ventnor Cons. ...	158—168	...	...
270,086	,,	Mar. 15	7	7	Slough Ord.	137—142	...	...
21,000	,,	Dec. 14	5	5	Do. 5 p.c. Deb.... ...	113—118	...	...
28,872	1	May 24	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	19/—21/-*	...	...
28,866	1	Mar. 15	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	18/6—20/6	...	...
137,730	Stk.	Feb. 15	7	7	Southgate & Dist. 7 p.c. max.	140—145	...	...
62,500	,,	,,	5	5	Do. 5 p.c. Pref.	110—115	...	...
117,228	,,	Feb. 15	6	5	Swindon Cons.	108—113	...	...
60,425	,,	Dec. 14	5	5	Do. 5 p.c. Deb.	113—118	...	115—116
64,380	,,	Dec. 14	5	5	Torquay and Paignton 5 p.c. Pf	115—120	...	...
1750,000	1	Apl. 5	4	6	Utd. Kingdom Gas Cpn. Ord.	20/6—22/6	...	21/—22/-
936,338	1	May 3	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	20/—22/-	...	21/—21/6
674,084	1	Apl. 5	4½	4½	Do. 4½ p.c. 2nd Non-Cum. Pref.... ...	17/6—19/6	−/6	17/7½
600,000	Stk.	Mar. 15	3½	3½	Do. 3½ p.c. Red. Deb. ...	96—99	...	97¾
130,000	,,	Feb. 15	5	8	Wakefield Ord.	126—131	...	...
81,650	,,	,,	5	5	Do. 5 p.c. max.	103—108	...	...
82,000	,,	Feb. 1	6	6	Weymouth Ord.	103—108	...	...
98,384	,,	Feb. 1	6	6	Wolverhampton 6 p.c. Pref....	125—130	...	...
160,000	,,	Dec. 14	5½	5½	Do. 5½ p.c. Rd. Db	110—115	...	...
370,000	,,	Feb. 15	4	6½	York Cons.	105—110	...	...
90,000	,,	Dec. 14	5	5½	Do. 5 p.c. Red. Deb. ...	105—110	...	...
133,640	,,	Mar. 1	6½	6½	Yorktown (Cam.) 5 p.c ons.	130—135	...	...
120,000	,,	,,	5	5	Do. 5 p.c. Pref.	110—115	...	...
35,000	,,	Dec. 14	5½	5½	Do. 5½ p.c. Deb.... ...	125—130	...	...

a The quotation per £1 of Stock b Actual for Quarter. * Ex div.

COMPANY NOTICES.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given that the TRANSFER BOOKS of this Company, relating to DEBENTURE STOCK only, WILL BE CLOSED from the 17th to the 30th June, 1937, both days inclusive.

By order of the Board,
K. LESLIE MORTIMORE,
General Manager and Secretary.

Gas-Works,
Hornsey, N. 8,
June 9, 1937.

UXBRIDGE, MAIDENHEAD, WYCOMBE, AND DISTRICT GAS COMPANY.

NOTICE is Hereby Given that the DEBENTURE TRANSFER BOOKS WILL BE CLOSED from the 16th to the 30th June, both days inclusive, and the Interest Warrants will be paid on the 1st July next to the Debenture Holders registered at the date of closing.

By order of the Board,
GEORGE J. BRISTOW,
Secretary.

162, High Street,
Uxbridge.

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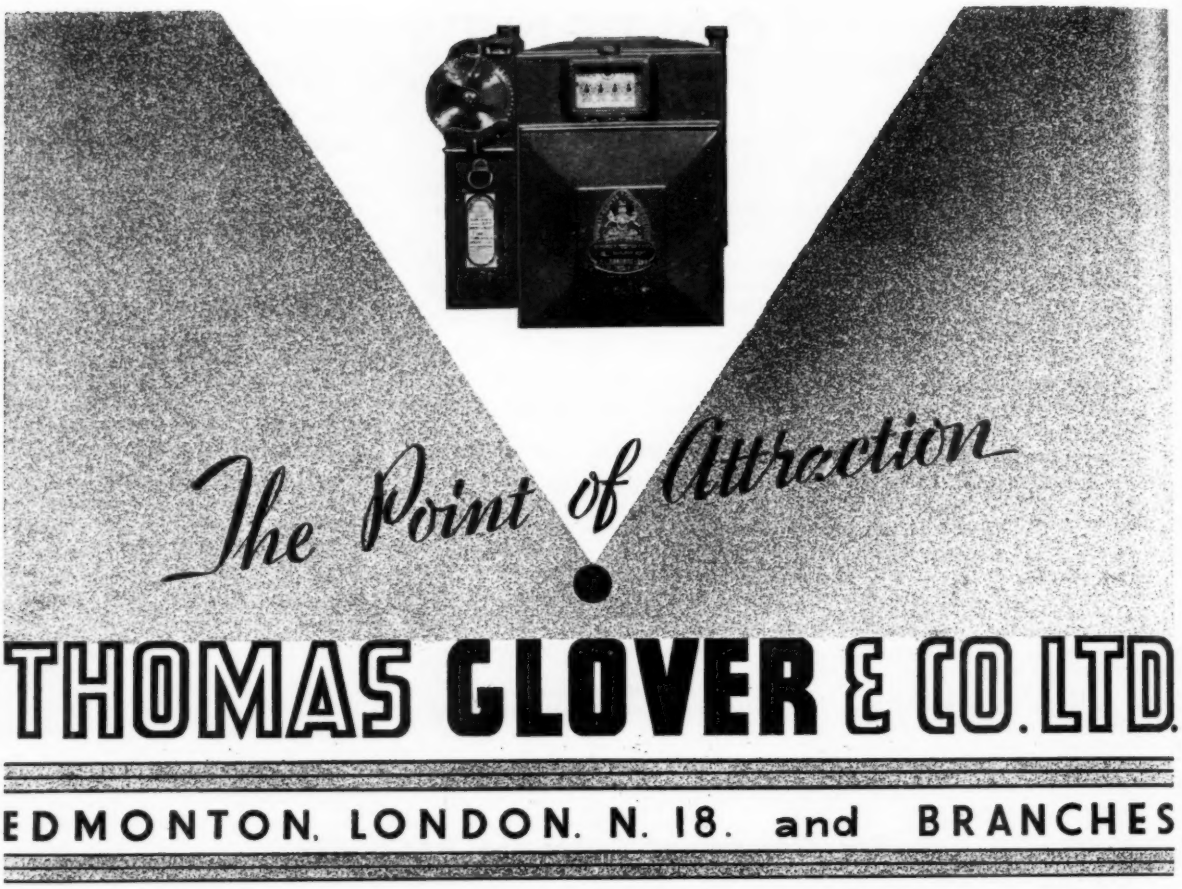
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